(2)

SIMULATION OF OIL SLICK TRANSPORT IN GREAT LAKES CONNECTING CHANNELS

Volume IV: User's Manual for the Microcomputer-Based Interactive Program

P.D. Yapa
R.J. Thomas, Jr.
R.S. Rutherford
H.T. Shen

Report No. 86-4
November 1986
Department of Civil and Environmental Engineering
Clarkson University
Potsdam • New York • 13676

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Report No. 86-4	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Clarkson University 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Department of Civil and Environmental Engineering Potsdam, NY 13676	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION U.S. Army Corps of Engineering 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER DACA 33-85-C-0001
8c. ADDRESS (City, State, and ZIP Code) Detroit District P.O. Box 1027 Detroit, MI 48231	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
Simulation of Oil Slick Transport In Great Lakes Connecting Channels; Volume IV: User's Manual for the Microcomputer - Based Interactive Program

12. PERSONAL AUTHOR(S)
Yapa, P.D., R.J. Thomas, R.S. Rutherford, H.T. Shen

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM _____ TO _____	November 1986	100

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	data files, graphics programs, hardware and software.

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

In this study, two computer models naved as ROSS and LROSS are developed for simulating oil slick transport in rivers and lakes, respectively. The oil slick transformation processes considered in these models include advection, spreading, evaporation, and dissolution. These models can be used for slicks of any shape originated from instantaneous or continuous spills in rivers and lakes with or without ice covers. Although developed for the need of the connecting channels in the upper Great Lakes, including the Detroit River, Lake St. Clair, St. Clair River and St. Marys River, these models are site independent nad can be used to other rivers and lakes. The programs are written in FORTRAN programming language to be compatible with FORTRAN77 compiler. The models are designed to be used on mainframe and microcomputers.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Jimmie L. Glover	22b. TELEPHONE (Include Area Code) (313) 226-7590 22c. OFFICE SYMBOL CENCE-PD-EA

SIMULATION OF OIL SLICK TRANSPORT IN GREAT LAKES CONNECTING CHANNELS

Volume IV: User's Manual for the Microcomputer-Based Interactive Program

by

Poojitha D. Yapa, Ronald J. Thomas, Jr., Randall S. Rutherford and Hung Tao Shen

Report No. 86-4

Department of Civil and Environmental Engineering
Clarkson University
Potsdam, New York 13676

November 1986

Sponsored by

U.S. Army Corps of Engineers
Contract No. DACA33-85 C-0001

This program is furnished by the Government and is accepted and used by the recipient upon the express understanding that the United States Government makes no warranties, express or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data contained in this program or furnished in connection therewith, and the United States Government shall be under no liability whatsoever to any person by reason of any use made thereof.

The program herein belongs to the Government. Therefore, the recipient further agrees not to assert any proprietary rights therein or to represent this program to anyone as other than a Government program.

ACKNOWLEDGEMENTS

This study was supported by the U.S. Army Corps of Engineers under Contract No. DACA33-85-C-0001. Steve F. Daly and Mike Ferrick of the U.S. Army Cold Regions Research and Engineering Laboratory are the contracting officer's technical representatives. The writers would like to thank both of them as well as Dan Thompson and Don Williams of the Detroit District, U.S. Army Corps of Engineers, for their cooperation and assistance throughout the study period.

The writers would also like to acknowledge the assistance provided by the following individuals during various stages of this study: J.R. Weiser and R. Thomas, Detroit District, U.S. Army Corps of Engineers; F.H. Quinn and D.J. Schwab, Great Lakes Environmental Research Laboratory, NOAA; J. Galt and T. Kaiser, NOAA; M. Sydor, Inland Water Directorate, Canada; G. Tsang and R.O. Ramseir, Environment Canada; D. Mackay, University of Toronto; J.A. McCorquodale, University of Windsor; and S. Venkatesh, Atmospheric Environment Service, Canada.

PREFACE

The growing concern over the possible impacts of oil spills on aquatic environments has led to the development of a large number of computer models for simulating the transport and spreading of oil slicks in surface water bodies. Almost all of these models were developed for coastal environments. With the increase in inland navigation activities, oil slick simulation models for rivers and lakes are needed.

In this study, two computer models named as ROSS and LROSS are developed for simulating oil slick transport in rivers and lakes, respectively. The study was orignated by the Detroit District, U.S. Army Corps of Engineers in relation to the Great Lakes limited navigation season extension study. The oil slick transformation processes considered in these models include advection, spreading, evaporation and dissolution. These models can be used for slicks of any shape originated from instantaneous or continuous spills in rivers and lakes with or without ice covers. Although developed for the need of the connecting channels in the upper Great Lakes, including the Detroit River, Lake St. Clair, St. Clair River, and St. Mary's River, these models are site independent and can be used to other rivers and lakes.

The programs are written in FORTRAN programming language to be compatible with FORTRAN77 complier. In addition, a user-friendly, menu driven program with graphics capability is developed for the IBM-PC AT computer, so that these models can be easily used to assist the oil spill clean up action in the connecting channels should a spill occur.

This report series is organized in four volumes, to provide a complete description of the analytical formulation of the models, the logic and structures of the computer programs, and the instructions for using the models. The title of these volumes are:

Volume I: Theory and Model Formulation

Volume II: User's Manual for the River Oil Spill Simulation Model (ROSS)

Volume III: User's Manual for the Lake-River Oil Spill Simulation Model (LROSS)

Volume IV: User's Manual for the Microcomputer-Based Interactive Program

VOLUME IV: USER'S MANUAL FOR MICROCOMPUTER-BASED INTERACTIVE PROGRAM

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER I

INTRODUCTION

This manual is written to provide the user with the necessary instructions to use the oil spill simulation models interactively on an IBM-PC AT computer. The interactive program, named as MENU, can perform a variety of tasks which include creating data files and running the computer programs for ROSS or LROSS, plotting results on the screen and obtaining plots on the attached HP plotter. These plots can be made available in both monochrome and color versions. In the color version the distribution of oil can be classified into 8 colors. In the monochrome version the oil slick is represented by a distribution of dots. While every effort has been made to make MENU as self-explanatory as possible on the screen, it is recommended that a first time user should read this manual before using the program. This manual will guide the user step by step through the program, while providing some additional information that is not readily available on the screen. It is expected that after one or two trial runs, the user will be able to use the program without consulting this manual. The hardware and software requirements for this program are given in Appendix I.

I.1. Start-Up Procedure and Choosing Options

All programs and data are in the hard disk drive. To execute this program turn the computer on with the switch on the right. Also turn the monitor on with the power switch on the lower right corner. Make sure that the computer is unlocked. The lock is on the front of the computer. When the power is switched on the necessary programs are loaded automatically and you will be in the main menu. At this point, the screen will display the following:

OILSPILL SIMULATION MODEL

(ROSS/LROSS)

Developed by the Department of Civil and Environmental Engineering
Clarkson University, Potsdam, New York 13676
under the support of the Detroit District, U.S. Army Corps of Engineers, through the Cold Regions Research and Engineering Laboratory, Hanover, N.H.

This program is furnished by the Government and is accepted and used by the recipient upon the express understanding that the United States Government makes no warranties, expressed or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data contained in this program or furnished in connection therewith, and the United States Government shall be under no liability whatsoever to any person by reason of any use made thereof. The program herein belongs to the Government. Therefore, the recipient further agrees not to assert any proprietary rights therein or represent this program to anyone as other than a Government program.

Hit any key to continue.

To continue with the program, hit any key to continue. Then the following will appear on the screen:

LROSS requires a large amount of memory. Therefore LROSS cannot be run while graphics programs are in memory. This is a limitation due to the available memory for IBM PC-AT.

If graphics programs are loaded, the machine has to be switched off and then switched on to run LROSS. You should therefore, now select whether you want to run LROSS or the other options [ROSS, Graphics, Interactive Data Creation].

This is the PRE-MENU for the Oilspill Simulation Programs.

NOTE: LROSS is for Lake St. Clair and Detroit River.

ROSS is for: St. Clair River
Detroit River
Upper St. Mary's River
Lower St. Mary's River

1 - Continue to MAIN MENU
2 - LROSS with output on the screen
3 - LROSS with output on the printer

At 'C ' hit the number (1, 2 or 3) and then hit ENTER

C >
C >

As indicated in the above display, there are three options to select at this stage. These options correspond to different combinations of tasks you can perform as explained in the block diagram in Fig. 1. It must be noted that if you have not created any datafiles the run will correspond to the set of datafiles assigned by the last user.

If option 1 is selected, you will enter the MAIN MENU where a variety of tasks can be performed, except running LROSS. The screen display will be as follows:

This is the main menu for the Oilspill Simulation Programs.

NOTE: LROSS is for Lake St. Clair and Detroit River

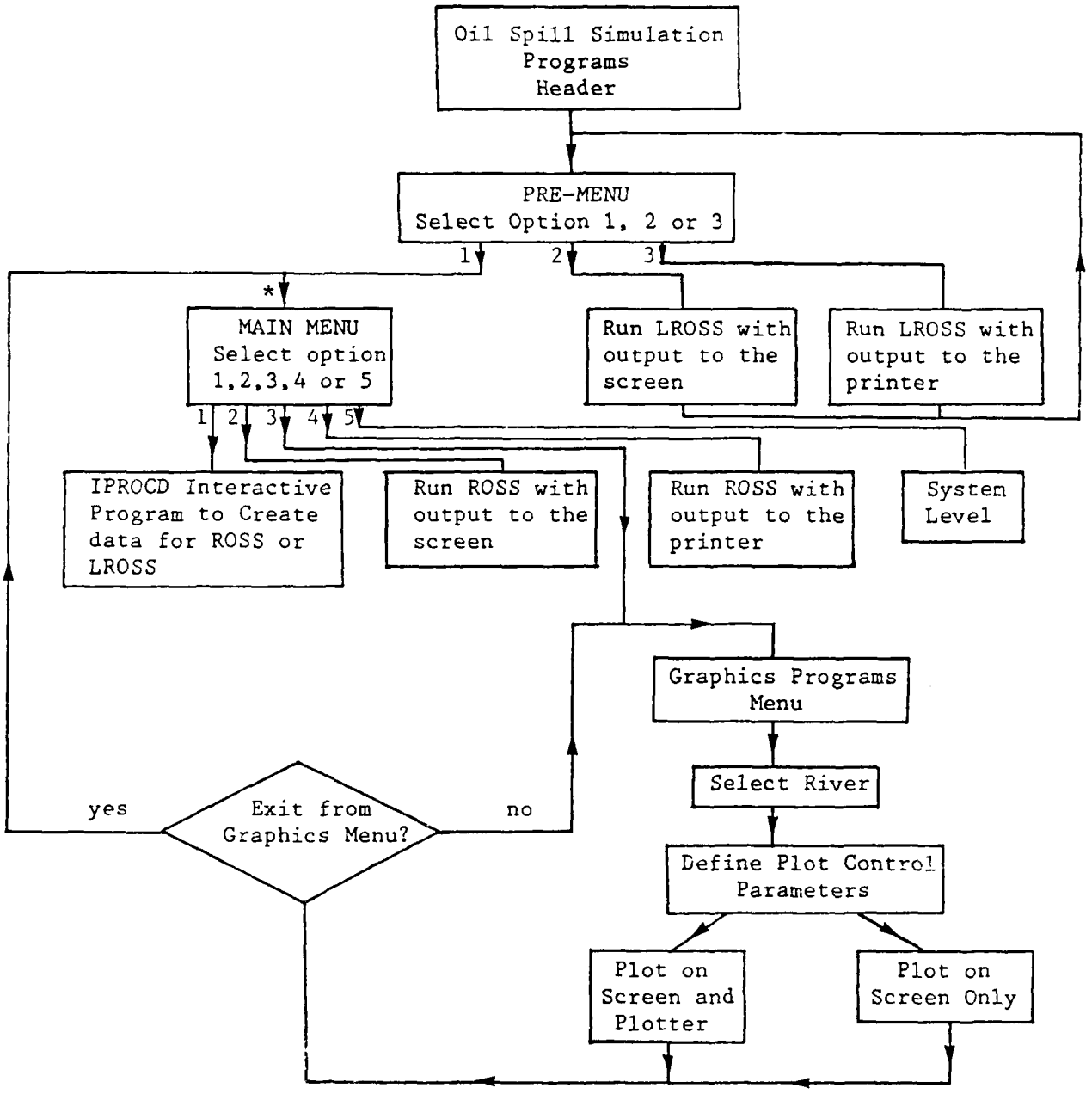
ROSS is for: St. Clair River
Detroit River
Upper St. Mary's River
Lower St. Mary's River

1 - Create data files IPROCD.BAS
2 - ROSS with output on the screen
3 - ROSS with output on the printer
4 - Graphic Routines IPROGR.BAS
5 - Exit

Hit the number of the desired option:

As indicated in the above display, there are five options to select from. These five options correspond to different combinations of tasks as shown in the flow chart in Fig. 1.

If option No. 1 is selected you will enter the program to create data files for ROSS or LROSS. This program is named IPROCD (Interactive Program for Creation of Data Files) for easier reference.



*If you wish to run LROSS, you have to switch the machine off and then on at this point.

Fig. 1. Flow Chart for the Menu Driven Program

After all the data files are created the computer will return to the MAIN MENU. At this point, you may either choose one of the five options in the MAIN MENU for the desired operation, or switch off and on the machine to go back to the PRE-MENU. The later operation will enable the user to run LROSS through options 2 or 3 in the PRE-MENU. If Option 3 is selected you will execute LROSS, using data files in the computer, with output being directed to the printer. In this case, you must ensure that the printer is properly connected and turned on. The power light, ready light and the "On Line" light on the printer must be lit. If any of these three lights are not lit or the paper out light is lit, consult the printer manual. At the termination of execution the computer will return to PRE-MENU. Option 2 executes LROSS, using data files in the computer, with output on the screen. At the termination of the execution the computer will return to PRE-MENU.

If you would like to run ROSS or graphic routines using existing data files, you can select options 2, 3 or 4 when you are at the MAIN MENU.

Option 2 of the MAIN MENU is to run the oil spill simulation model ROSS. With this option all output from the program will be directed to the screen. If you wish to have a hardcopy of this output then Option 3 should be selected. In this case, you must ensure that the printer is properly connected and turned on. The power light, ready light and the "On Line" light on the printer must be lit. If any of these three lights are not lit or the paper out light is lit, consult the printer manual.

The Option 4 of the MAIN MENU is to execute the graphics and/or plotting routines. These routines were developed for displaying oil spill simulation results graphically and drive the plotter. They can also perform a variety of other tasks. The reader should consult Chapter III of this manual for more details.

The fifth option in the MAIN MENU is to exit from the MAIN MENU and

return to the DOS (system) level. This option is for experienced users only[1].

When you hit the number of the desired option the program will directly proceed to that segment of the program. Since there are no additional operations involved in Options 2, 3 and 5 of the MAIN MENU and Options 2 and 3 of the PRE-MENU, only Options 1 and 4 of the MAIN MENU need further discussions. The procedures involved in these two options will be discussed in detail in the Chapters II and III, respectively.

[1]After you exit to the system level, the HALO driver is still in the computer memory. HALO is a subroutine package. Some of these subroutines are used in the graphics part of this program. Loading HALO to the memory more than once causes problems. Once you are in the system level you can do copying or deleting files. For renaming use COPY filename1 filename2. When you want to get back to the menu from the system level, type 6 and return. This will take you back to the menu without reloading HALO.

CHAPTER II

CREATION OF DATA FILES

II.1. Determining File Name

The first step in the data creation program, IPROCD is to enter the name of the data files to be created. Upon entering IPROCD the screen will display:

This program interactively creates the input data files necessary to run the Fortran programs ROSS and LROSS.

Enter the first 6 characters which defines the filenames.
The unit numbers will be automatically assigned by the program.

> STCL11

Names for all data files that are needed for a ROSS or LROSS run all consist of a name formed by not more than six characters and a three character extension, i.e. YYYYYY.xxx. The first portion are common for all data files in a specific computer run. The extensions are defined by the program to be compatible with the requirements of ROSS and LROSS. The user can define the first six characters. The output file from ROSS/LROSS where plotting data will be stored has a name starting with four/five characters defined in the table below plus SP.OUT. For example, if you are running for the Detroit River, the output file will be DETRSP.OUT. This will become the input file for plotting programs. In selecting the filename, it is recommended that the first four/five characters be used to identify the river or lake systems, as given in the following table:

FIRST FOUR/FIVE CHARACTERS	:	RIVER / LAKE
STCL	:	St. Clair River
DETR	:	Detroit River
STMU	:	Upper St. Mary's River
STML	:	Lower St. Mary's River
LDETR	:	Lake St. Clair & Detroit River

The 5th and 6th characters (for lake runs only 6th character) can be used to identify the run number. For example, the 11th run of St. Clair River will have STCL11.xxx, where xxx is the extension that will be added by the program based on the type of data. These characters are used to save data files (if any) that will be created during data creation. After typing in the filename, hit return. If you entered STCL11 the screen will now display:

```
-----------------------------------------------
The six characters entered are: STCL11
Is this correct? ( Y / N )
-----------------------------------------------
```

This gives the user a chance to correct a mistyped name. If the six characters entered are correct, hit the 'Y' key.

IPROCD can create data files for either ROSS or LROSS programs. There are slight differences between the datafiles of ROSS and LROSS. After answering the question in the above section the following will appear on the screen:

```
-----------------------------------------------------
Will these data be created for ROSS or LROSS? ( R / L ):
-----------------------------------------------------
```

The program asks for which program the data is to be created for, i.e.

(ROSS - River Oil Spill Simulation),

or (LROSS - Lake and River Oil Spill Simulation)?

You should select the oil spill simulation model appropriate for the spill site, and answer this question by hitting 'R' for ROSS or 'L' for LROSS.

II.2. Creating Data Files

The program IPROCD has several subsections. Each subsection will create one of the datafiles that will be used by the Oil Spill Simulation Model ROSS or LROSS. The program allows you to create these datafiles one by one. You may skip any one of the datafiles if you already have one with desired data. This feature is executed by prompting the user to answer 'Y' or 'N' in each subsection for the datafile to be created. The details of these subsections and instructions for creating the datafiles are given as the following:

Subsection SPL

The first data file has the extension SPL. This file consists of two blocks of data. The first block contains oil characteristics and simulation parameters. The second block contains wind and temperature data. You may choose to create this file when the following appears on the screen:

This segment of the program creates the file with the extension SPL.
(This file contains oil characteristics, simulation parameters and weather data.)

Would you like to proceed in this section? (If you enter No, this data file will not be created.) (Y / N) :

If you wish to create or change this data file hit 'Y' or else hit 'N' if you wish to skip creating this file.

Instructions for Creating Subsection **SPL**

Following is the first question in this section:

```
--------------------------
What type of oil?
     1 - Gasoline
     2 - Bunker C
     3 - Fuel Oil No. 2
     4 - Other
--------------------------
```

The question prompts the user to enter the type of oil to be used in the simulation. To answer this question just hit the desired option number. If you enter 1, 2 or 3, your answer will be used later on in this subroutine for determining oil characteristics. The parametric values that define oil characteristics will be displayed at the appropriate occasion on the screen, but you can override and change them. If you select option '4' the program will prompt you to enter the parametric values that define characteristics at appropriate places. Example:

```
--------------------------
What is the type of oil?
--------------------------
```

Suppose you answered kerosene. The program will give a chance to make a correction by displaying:

```
---------------------------------
The oil selected is:  kerosene
Is this correct? (Y/N):
---------------------------------
```

If this is correct, type 'Y' or else 'N'.

The rest of the discussion will be continued assuming you selected oil type 1 which is gasoline. After typing in this response, hit return. The following will appear on the screen:

```
------------------------------
The oil selected is:  Gasoline
Is this correct?  ( Y / N ) :
------------------------------
```

If a mistake was made in typing in the type of oil, hit the 'N' key. If the type of oil is correct, hit the 'Y' key. Then a series of seven questions will follow:

What is the total time of oil spill simulation in hours?

Note: This value must exceed the time step in unsteady flow model, i.e. in FLW file.
If you plan to use any of the default FLW files the answer to this question must exceed 24 hrs. If this causes inconvenience you can create FLW data files with a smaller time step.

What is the frequency of obtaining output from PLOTNU and other subroutines, i.e., '1' for every step, '2' for every other step. [1] ?

Would you like to have cross section geometry data and shore conditions data (written to a separate file.) (0-No / 1-YES) : [0] ?

Would you like an output of particle locations to a datafile to be used in plotting (0-NO / 1-YES) : [1] ?

Would you like a printer/screen number plot of oil slick particle distribution (refer to reference manual) (0-No / 1-YES) : [0] ?

What is the duration of oil spill (hrs.) : [1.0] ?

Do you wish to use the default formulation for the horizontal diffusion?
For river?
Hit the return key for the default formulation or enter the desired value for horizontal diffusion coefficient. (sq. ft/sec)

The first question asks for the total time of oilspill simulation in hours. To answer this question, type in the time in numerics and then hit return.

The second question asks for the frequency of obtaining output from the subroutine PLOTNU and other subroutines. PLOTNU plots represent the oil

concentration by the distribution of the number of particles in each grid. For example, inputing a value two (2) will give output every other time step. Other outputs include the spill information on the screen/printer and datafile created for later use in plotting. The datafile used for plotting tends to become large for longer simulations. The size of this datafile can be reduced by not writing information every time step. The default for this question is one (1) as seen between the brackets. If the default value is to be used, hit the return key. Otherwise, type in the selected value and hit the return key.

The third question asks if an output of fixed data (cross sectional geometry and shore conditions) is desired. If this is answered with a one (1) the output will be written to a separate output file. An answer of zero (0) means this output file will not be created. To answer this question, hit return key to accept the default value or type in the selected value and hit the return key.

The fourth question asks if an output of particle locations to a data file to be used in plotting is desired. The answering pattern is similar to that of the previous question.

The fifth question is to determine if a printer/screen number plot is desired for particle distribution. The output destination (printer/screen) depends on which choice is selected in the main menu. If this question is answered with one (1) a number plot such as the example shown below in Fig. 2 will be generated during the execution of ROSS or LROSS.

The sixth question is to find the duration of the oilspill. This variable determines whether the spill is to be treated as continuous or instantaneous.

ROSS and LROSS allows two different options for computing the horizontal diffusion coefficient. The seventh question allows you to choose the option

desired. To answer this question just hit the return key to accept the default formulation, or type in the horizontal diffusion coefficient and then hit the return key. If you are creating data for LROSS, you will have to enter the diffusion coefficient for the lake in addition to the one for the river. The questions and answers in both cases are similar. (The details of the default formulation is given in Vol. I of the report.).

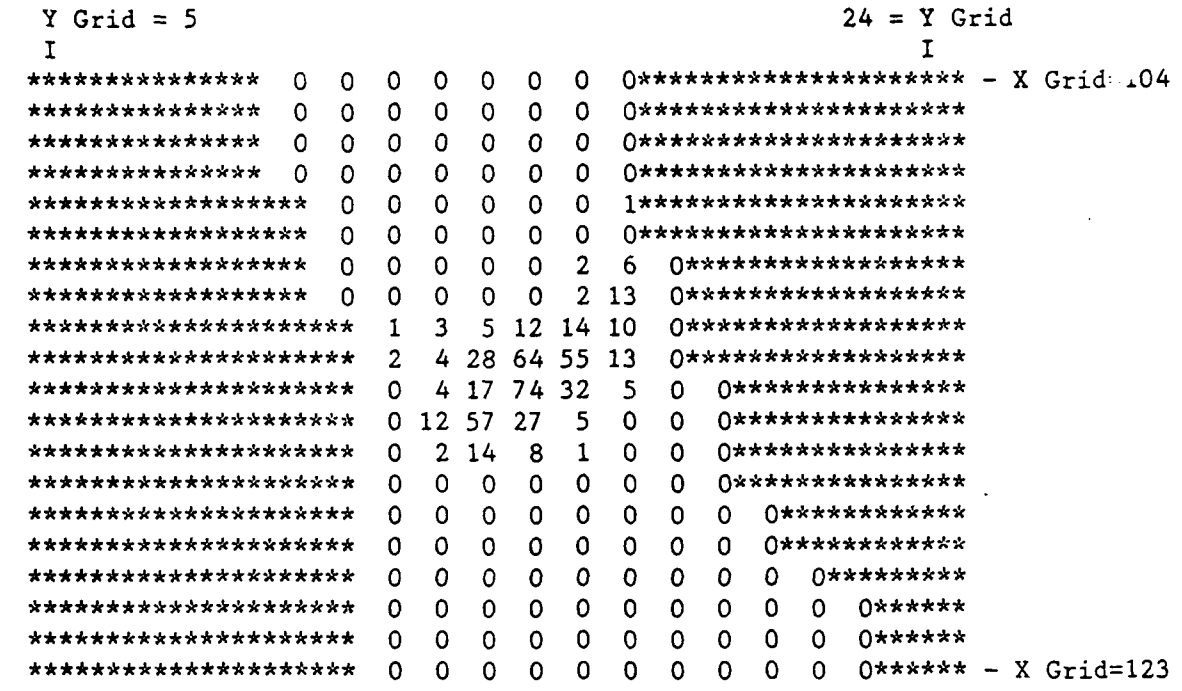


Fig. 2. Sample Output from PLOTNU Subroutine

After answering this series of questions, the user will be given a chance to determine if he/she has entered the correct numbers. The following will be displayed on the screen for verification:

Total time of oil spill simulation (hrs.) : 4

Frequency of obtaining output form PLOTNU and other subroutines

```
(Number of steps between outputs) : 1

Output of fixed data cross section geometry and shore conditions
( 0-NO / 1-YES ) : 0

Output of particle locations to a datafile to be used in plotting
( 0-NO / 1-YES ) : 0

Printer/screen number plot of particle distribution
( 0-NO / 1-YES ) : 0

Duration of oilspill (hrs.) : 1.0

River-Default formulation for the horizontal diffusion coefficient has been
selected.
Is the above information correct? ( Y / N ) :
```

If the information that the program printed on the screen is correct, hit the 'Y' key. If the information is incorrect, hit the 'N' key. If you answered 'N' the series of questions will be repeated and you will have a chance to correct the mistakes.

Next a series of questions will be asked to determine spill characteristics. The following is the list of questions:

```
What is the total number of particles defined in the system? [500]
(Maximum allowed is 1000)

What is the total volume of the oil spill (U.S. gal.) ?

What is the length of time step for simulation? : [15] min

What is the specific gravity of oil? Gasoline [0.7]

What is the kinematic viscosity of water? [ 141.100E-07] sq ft/sec

What is the surface tension of oil? Gasoline [0.7550E-03] lbs/ft
```

The first question is for specifying the number of particles to be used to represent the oil slick. The default value is 500 as shown inside the

brackets. If this value is desired, just hit return. If a different value is desired, type in the value and then hit return. If you typed in a number larger than the maximum of 1000, the maximum value of 1000 will be written to the data file and the following message will appear:

```
------------------------
1000 has been entered
------------------------
```

The second question is for specifying the total volume of oil spilled in U.S. gallons. This is the total volume of oil spilled, whether the spill is instantaneous or continuous. To answer this question, type in the value and then hit return.

The third question is for specifying the length of the time step for oilspill simulation. The default value is 15 minutes. If the default value is desired hit the return key. If a different value is desired, type in the new value and then hit the return key.

The next three questions are for specifying specific gravity of oil, kinematic viscosity of water (ft^2/sec) and surface tension of oil (lbs/ft) respectively. Depending on the type of oil that was defined previously, the default values for that type of oil are displayed. If the type of oil is not one of the three that were listed, an alternate default value will be shown. If the default value is desired just hit return. If a different value is desired, type in the new value and then hit the return key.

Once the answering of the above series of questions is completed, a summary will be displayed on the screen to give an opportunity to the user to re-check and correct any mistakes. The screen appears as follows (the numbers shown are for a sample case):

Total number of particles defined in the system : 1000

Total volume of oilspill (U.S. gal.) : 5000

Length of time step for spill simulation : 15 min

Specific gravity of oil : .7

Kinematic viscosity of water : 1.411E-05 (sq ft/sec)

Surface tension of oil: .000755 (lbs/ft)

Is the above information correct? (Y / N)

If the information is correct hit the 'Y' key. If the information is not correct hit the 'N' key. If the latter is chosen, the series of questions will be repeated giving the user an opportunity to correct any mistakes. The next series of questions will be as follows:

What is the X-coordinate of spill site (ft) ?

What is the Y-coordinate of spill site (ft) ?

What is the molar volume of oil? [.7063E-02] (cu ft/mol)

What is the solubility of fresh oil? Gasoline [0.873E-02] lbs/cu ft

What is the boiling point temperature of oil? Note: Characteristic curves for the oils will be used if you enter a value less than 1.0 for the boiling point temperature. If you choose this option the value of coefficient C will be automatically be computed. Gasoline [311.0] deg.K

What is the coefficient C of evaporation characteristics of oil?
Gasoline [6.11]

The first and second questions ask for the location of the oilspill. The coordinates of the spill can be found by going into the graphical routines and moving a marker around on the map where the spill took place. To answer these

questions, type in the coordinates of the spill and then hit the return key.

The third and fourth questions are for finding the appropriate values of the molar volume of oil (cu ft/mol.) and solubility of fresh oil (lbs/cu. ft) respectively. The default values are shown after the question in brackets. If the default values are acceptable just hit the return key. If a different value is desired, type in the desired value and hit the return key.

The fifth question asks for the boiling point temperature of oil in degrees Kelvin. Characteristic curves for crude oils will be used if you enter a value less than 1.0 for the boiling point temperature of oil. These characteristic curves are described in detail in Vol. I of the report. If you enter a value less than 1.0 the sixth question in this series will not be asked, but will automatically be computed. Each type of oil may have a different value. The default value for this question is shown between the brackets. If the default value is desired hit the return key. If a different value is desired, type in the value and hit the return key.

The sixth question asks for the coefficient C of evaporation characteristics of oil. The default value for this question is shown between the brackets. If the default value is desired hit the return key. If a different value is desired, type in the value and hit the return key.

After answering this series of questions, the following will appear on the screen:

```
X-coordinate of spill site is : 0 ft.
Y-coordinate of spill iste is : 0 ft
Molar volume of oil is : .007063 cu ft/mol
Solubility of fresh oil is : .00873 lbs/cu ft
Coefficient C of evaporation characteristics of oil is : 6.11
Boiling point temperature of oil is : 311 deg K
Is the above information correct? ( Y / N ) :
```

If the above information is correct hit the 'Y' key. If any of these values need to be changed the user can prompt this set of questions again by hitting the 'N' key.

After this series of questions has been completed, the following series of three questions will be asked:

We are now entering data needed for the hour #1 wind and air temperature.

What is the wind speed (mph) ? [0.0]

What is the wind direction (clockwise angle measured from North in degrees)? : [0.0]

What is the air temperature in deg. F.? [0.0]

These questions pertain to the first hour of wind data and air temperatures after the oilspill started.

The first question in this series is to determine the wind speed in mph. To answer this question, type in the desired value and then hit the return key or if the default value is desired, just hit the return key.

The second question asks for the wind direction. This is the clockwise angle measured from North in degrees. For example, the angle for wind out of the West is 270^{o}. To answer this question, type in the desired value and then hit the return key or just hit the return key to accept the default value.

The last question in this series is to determine the air temperature in ^{o}F. To answer this question, type in the desired value and then hit the return key.

When the answering to this series of questions is complete, a summary of the data entered will be displayed on the screen for the user to verify. The display on the screen will look as follows:

```
Data for hour #1 of simulation

Wind speed is: 5.0 mph (7.3 ft/s)

Wind direction is : 90 deg.

Air temperature is : 50 deg.F

Is the above information correct?  ( Y / N ) :
```

If the information is correct, hit the 'Y' key. If you need to change any of the information, hit the 'N' key. If the latter is chosen the program will prompt you to answer this series of questions again. If the former is chosen, the program will ask the following question:

```
Would you like to 'R'epeat the above values for hour #2 or enter 'N'ew values?
( R / N ) :
```

For every hour the oilspill simulation model will run, wind velocity and air temperature are needed. The program is designed in such a way that if the data for the second hour are the same as the previous hour, you can simply hit 'R' key. If a different value is desired for one or more questions, hit the 'N' key to enter new values for wind velocity and air temperature. The program will repeat this question until data for the simulation period has been entered. When this is complete the following messages will appear on the screen:

```
File STCL11.SPL has been saved.
Hit any key to continue
```

At this point all of the data for the data file with the extension of SPL has been created. This data is stored on the disk to be used later by ROSS or LROSS.

Subsection FLW

This subsection creates the datafile with the extension FLW. This subsection contains the water level and discharge at each node in the river as defined by the one dimensional flow model. Also included are the ice conditions at each cross section in the river. This data is independent from the ice region data in the ICE data file. This data file consists of three blocks of data. The first block contains a single entry data and it is for the time step in the one dimensional model. The second block contains data for the discharge and water level. Ice conditions (ice thickness information) is in the third block of data. The program asks whether to create this data file or not, by displaying the following on the screen:

```
---------------------------------------------------------------------------
This segment of the program creates the file with the extension FLW.
(This file contains data needed to compute flow distribution in river.)

If you want to use one of the default flow data files (low, medium, high flow)
you may skip this section.

Would you like to proceed in this section? (If you enter No, this data file
will not be created.)  ( Y / N ) :
---------------------------------------------------------------------------
```

If you wish to create this data file hit the 'Y' key, or else hit 'N' key.

Instructions for Creating Subsection **FLW**

Upon entering this subsection, the following will appear on the screen:

```
---------------------------------------------------------------------------
What is the time step for river flow computation (hrs)
NOTE: This cannot exceed total simulation period. ?
---------------------------------------------------------------------------
```

The question prompts you to enter the time step (hrs) for one dimensional river flow computation. This value must not exceed the total simulation period as defined in Subsection SPL. To answer this question type in the

number of hours of this time step and hit the return key. Suppose you typed 4 and hit the return key. The computer will give you a chance to verify it by displaying the following message on the screen:

```
-------------------------------------------------------------------
Is the time step for river flow computation 4.0 hrs.? ( Y / N ) :
-------------------------------------------------------------------
```

You can acknowledge the value by hitting 'Y' key. If the value is incorrect, hit the 'N' key.

The next section pertains to the discharge and water level at the nodes of the river branches in the unsteady flow model. The questions are as follows:

```
-------------------------------------
Node No. 1
What is the water level?  [45.34] ft
What is the discharge?  [43432.3] cfs
-------------------------------------
```

The first question asks for the water level in feet above the reference datum at the node number as stated above. If the value in brackets after the question is the correct value, just hit the return key. If this value is not correct, type in the correct value and then hit the return key.

The second question asks for the discharge in cubic feet per second at the node as stated. If the value in brackets after the question is the correct value, just hit the return key. If this value is not correct, type in the correct value and then hit the return key.

After answering these questions, the program will check with you to see if the values that were entered are correct. The screen appears as follows:

Node No. 1

Water level is 45.34 ft

Discharge is 43432.3 cfs

Is this information correct? (Y / N) :

If the data for each of the statements is correct, hit the 'Y' key. If any of them are wrong, hit the 'N' key to repeat the set of questions.

Once the data for a particular node is confirmed, it will prompt you to enter the data for the next node. These questions will end once the water levels and dishcarges have been entered for all the nodes in the river. IPROCD knows the exact number of nodes in the river if you used one of the first four/five character sets recommended for the filenames.

The next question will ask how many cross sections are ice covered. The question is:

What is the number of cross sections with ice covered conditions?

To answer this question, type in the number of cross sections which are ice covered and hit the return key. If you are creating data for open water conditions, you may enter 0. The program verifies the value you entered, e.g. 3, by asking the following question:

Is number of cross sections with ice covered conditions: 3 ? (Y / N)

If this is the correct value, hit the 'Y' key. You may correct the value by hitting 'N' key.

It is now necessary to identify each cross section. This is done by asking the following question:

```
-----------------------------------
What is the cross section no.?
-----------------------------------
```

You can answer this question by typing the cross section number and then hit the return key. In order to determine the ice cover condition IPROCD will prompt the following question:

```
-------------------------------------------------------------------------
The cross section ice cover condition is: ( 1-FULL / 2-PART / 3-OPEN )
-------------------------------------------------------------------------
```

If the cross section is completely ice covered select option one (1). If the cross section is partially covered with ice, select option two (2). If the cross section does not have an ice cover condition select option three (3). To answer this question hit the number of the option that is desired. The IPROCD will verify your entries by asking the following question (The illustration below assumes you that answered with 1):

```
-----------------------------------------------------------
Cross section No.  1 has a(n) FULL ice condition.
Is this correct?  ( Y / N ) :
-----------------------------------------------------------
```

If the information that was entered is correct, hit the 'Y' key. If you answered by hitting the 'N' key, IPROCD will give you another chance to correct the previous entries.

At this point IPROCD will do one of the following depending on the ice cover option that was selected.

Option "1" Full Ice Cover

When this option is selected you need to give only one ice thickness for the entire cross section. This a convenient feature for the user when ice cover across the cross section is uniform. If you have a full ice cover, but is non-uniform you must select the "2"-PART option. When IPROCD enters option

"1", the following will be displayed on the screen:

```
-------------------------------------------
What is the thickness of the ice? (ft):
-------------------------------------------
```

Answer this question by typing the value of ice thickness, e.g. 1.87, and then hitting the return key. IPROCD will verify the value by displaying

```
-------------------------------------------
Is the ice thickness 1.87 ft. ? ( Y / N ) :
-------------------------------------------
```

If the value is incorrect, hitting the 'N' key will give you another chance to specify ice thickness. If the value entered is correct hit the 'Y' key.

At this point the program can do two different things. If there is another ice covered condition that data must be entered for the program will go back to the cross section number. This will depend on the value you specified for the number of cross sections with ice covered conditions. You do not need to remember anything. IPROCD will prompt you until you have completed data for all ice covered sections. If the data for all the cross sections have been completed IPROCD will ask if there is another time step. The display will be as follows:

```
-----------------------------------------------------------------
Do you need time step 2 for river flow computation?  ( Y / N ) :
-----------------------------------------------------------------
```

To enter into this loop hit the 'Y' key. You may enter the data for another time step similar to the one before. If another time step is not needed, hit the 'N' key and the following will appear on the screen:

```
---------------------------------
File STCL11.FLW has been saved.
Hit any key to continue.
---------------------------------
```

At this point all of the data that is needed for this datafile has been entered. Just hit any key to continue.

Option "2" Partial Ice Cover

The geometry of a river cross section is considered to be an assembly of trapezoids. Each cross section has a number of sounding depths (vertical lines) that define the cross section. In order to find the number of vertical lines that defines the cross section you must know the name of the river and cross section number. The number of vertical lines and their distances from the left bank of the river can be found in Table A1 of Vol. II.

```
---------------------------------------------------------------------------
How many sounding depths (vertical lines) define this cross section?
(See supplied table) : ?
---------------------------------------------------------------------------
```

Suppose you answered by typing 5 and hitting return. IPROCD will verify your entry by displaying

```
---------------------------------------------------------------
Are there 5 sounding depths in this cross section?  ( Y / N ) :
---------------------------------------------------------------
```

You will get a second chance to correct the above value by answering 'N' to the above question. Otherwise, hit 'Y' key.

The cross sectional profile of the ice cover is defined by giving the ice thickness at the vertical lines. You have already entered the number of vertical lines that define cross section. IPROCD will prompt you to enter ice thickness data for each of these vertical lines by displaying:

```
------------------------------------------------------------
What is the ice thickness (ft) at vertical line # 1 ?
------------------------------------------------------------
```

Answer this question by typing the desired value (e.g. 1.05) and hitting the return key. Then IPROCD will give you a chance to verify your entry by displaying:

```
------------------------------------------------------------------
Is the ice thickness at vertical line 1 :  1.05 ft ( Y / N ) :
------------------------------------------------------------------
```

You may acknowledge the value by typing 'Y'. Typing 'N' gives you a chance for error recovery. This above sequence will be continued until data for all the vertical lines have been entered.

Option "3" Open Ice Condition

When this option is selected the screen display will be:

```
-------------------------------------------------
Cross section no. xx has a(n) OPEN ice condition.
Is this correct?  ( Y / N ) :
-------------------------------------------------
```

You can verify it by typing 'Y'. Typing 'N' gives you the opportunity to redefine the ice conditions for this cross section.

Subsection ICE

This subsection creates the data file with the extension ICE. This data file consists of one data block. This block contains information identifying the areal coverage of ice regions. The data can be changed for every time step of the one dimensional flow model. If ice region data does not change from one time step to another in the one dimensional flow model, the same data as the previous step must be entered for the present time step. An ice region is a range of grid boxes covered by ice. This information is used to

determine whether spreading and advection takes place under an ice cover or on open water. The program asks whether to create this data file or not by displaying the following on the screen:

```
---------------------------------------------------------------------------
This segment of the program creates the data file with the extension ICE.
(This file contains the areal coverage of ice.)

Would you like to proceed in this section? (If you enter No, this data file
will not be created.) ( Y / N ) :
---------------------------------------------------------------------------
```

If you wish to create or change this data file hit 'Y' or else hit 'N'.

Instructions for Creating Subsection **ICE**

The first question in this subsection asks if you are running for an open water case. The question is as follows:

```
-----------------------------------------------------
Are you running for an open water case? ( Y / N )
-----------------------------------------------------
```

If the oilspill simulation model will be run for an open water case, hit the 'Y' key. If this is done then the program will ask no more questions in this subsection. The program will display the following on the screen:

```
----------------------------
To continue hit any key.
----------------------------
```

If the oilspill simulation model will not be run for an open water case, then hit the 'N' key.

The following parameters are needed for simulating oil spreading under ice.

```
-----------------------------------------------------
What is Manning's n for ice roughness? [0.035]
What is the viscosity of oil? [0.84] lbs/ft sec
-----------------------------------------------------
```

The first question asks for Manning's n for ice cover. The default value for this question is inside the brackets after the question. The default value may be entered by just hitting the return key. If a different value is desired, type in the value and hit the return key.

The second question asks for the viscosity of oil. The default value for this question is inside the brackets after the question. Again you may follow the same procedrue as for the first question.

Verification of these two entries are done by displaying:

```
-------------------------------------------------
Manning's n for ice roughness:  .035
Viscosity of oil:  .84 (lbs/ft sec)
Is the above information correct?  ( Y / N ) :
-------------------------------------------------
```

If the information is not correct, hit the 'N' key. This will give you a chance to re-enter the values. You may acknowledge the values by hitting the 'Y' key.

The program branches off in two directions at this point. Very early in IPROCD a question was asked to determine if this data was to be created for ROSS or LROSS. The answer to this question decides which option the program will take.

ROSS Option

The following statement and question will appear on the screen at this point:

```
-----------------------------------------
For the unsteady flow model time step:  1
What is the total number of ice regions?
-----------------------------------------
```

These are the ice regions as seen from a plan view. A maximum of 20 is

allowed in the current versions of ROSS and LROSS. If you answered this question by typing in a number (e.g. 3) and hitting the return key, the following will appear on the screen:

```
---------------------------------------
The total number of ice regions is : 3
Is this correct?  ( Y / N ) :
---------------------------------------
```

This is the verifying stage. Once again you can type either 'Y' or 'N'. If you answered 'Y' the following four questions will appear on the screen sequentially; as you answer each question.

```
-----------------------------------------
Ice region no.  1
The x grid at the beginning of ice region?
The y grid at the beginning of ice region?
The x grid at the end of ice region?
The y grid at the end of ice region?
-----------------------------------------
```

These four parameters define an ice region. (Consult Vol. II for details.) To answer these questions, type in the requested number and hit the return key. After all four questions have been answered the following summary will be printed on the screen for verification (the numbers for x,y on the illustration below are for a sample case):

```
-------------------------------------------------
Ice region no.  3
The x,y grid 15 , 18 to the x,y grid 70, 28
Is the above information correct?  ( Y / N ) :
-------------------------------------------------
```

If the entered information is incorrect, hit the 'N' key and the questions will be repeated. If the information is correct, hit the 'Y' key. This set of questions will be repeated until data entering is complete for all ice regions. Once this is complete the procedure can be repeated for another

time step. At this stage the display on the screen will be:

```
--------------------------------------------------------------------------------
Would you like to enter data for another time interval?  ( Y / N ) :
--------------------------------------------------------------------------------
```

If you answer by typing 'Y' you will be asked to input ice region information for another time step. It is possible that ice regions exist only for some time steps. If this is the case you must answer 'Y' to the following question x number of times, where x = no. of time steps (That means you must have ice region data that corresponds to each time step of the one-dimensional model, regardless of whether the river has ice or not. However, if there is no ice, your entries are simpler.):

```
--------------------------------------------------------------------------------
Would you like to enter data for another time interval? ( Y / N )
--------------------------------------------------------------------------------
```

Then for the time steps without ice answer 0 (zero) to the question:

```
--------------------------------------
The total number of ice regions:
--------------------------------------
```

If you have given ice region information for all the steps, hit the 'N' key and the following will appear on the screen:

```
--------------------------------
File STCL11.ICE has been saved.
Hit any key to continue.
--------------------------------
```

All the data for this file has now been entered and the file has been saved. Hit any key to continue on with the program.

LROSS Option

In LROSS you need to specify lake ice regions as well as river ice regions. However, if you do not plan to run the simulation until the spill enters the river, you need not worry about the river ice regions. In the current version the total number of ice regions cannot exceed 20. The following statement and questions will appear on the screen at this point:

```
-------------------------------------------

For the unsteady flow model time step:  1
What is the total number of ice regions?
What is the number of ice regions in lake?

-------------------------------------------
```

Answer these questions by typing in the appropriate values and then hitting return key.

IPROCD will verify your entries by displaying (the numbers are for a sample case):

```
-----------------------------------------------

The total number of ice regions is :  3
The total number of ice regions in lake is :  2
Is this correct?  ( Y / N ) :

-----------------------------------------------
```

If the information entered is not correct, hit the 'N' key to re-prompt the questions. Otherwise, hit 'Y' key to continue.

At this point the following five questions will appear on the screen sequentially, as you answer each question:

NOTE: Lake ice regions must be input first.

Ice region No. 1
The x grid at the beginning of ice region?
The y grid at the beginning of ice region?
The x grid at the end of ice region?
The y grid at the end of ice region?
The ice thickness in lake ice region (ft.)?

The first four parameters define the location of an ice region. (If more details are desired, consult Vol. II.)

The fifth question defines the ice thickness for the region. This question will appear only when you are entering data for lake ice regions. To answer these questions, type in the requested number and hit the return key.

When all five or four questions have been answered, a summary as shown in the following will be printed on the screen for verification:

Ice region No. 1
The x,y grid 28, 23 to the x,y grid 28, 33
The ice thickness in lake ice region is: 0.75
Is the above information correct? (Y / N) :

If the information is incorrect, hit the 'N' key and the questions will be repeated. If the information is correct, hit the 'Y' key. This set of questions will be repeated until the data entering process is completed for all ice regions. When you are entering data for lake ice regions, you will see five questions, and after that only the first four questions will be asked for river ice regions. Once this is completed the procedure can be repeated for another time step. At this stage the display on the screen will be:

```
-------------------------------------------------------------------------
Would you like to enter data for another time interval?  ( Y / N ) :
-------------------------------------------------------------------------
```

If you answer by typing 'Y' ice region information can be repeated for another time step. It is possible that ice regions exist only for some time steps. If this is the case you must answer 'Y' to the following question x number of times, where x = no. of time steps:

```
-------------------------------------------------------------------------
Would you like to enter data for another time interval? ( Y / N )
-------------------------------------------------------------------------
```

If you do not need to enter ice region data for another time interval hit the 'N' key and the following will appear on the screen:

```
-----------------------------------

File test.ICE has been saved.
Hit any key to continue.

-----------------------------------
```

All the data for this file has now been entered and the file has been saved. To continue on with the program hit any key.

Subsection BND

This subsection creates the data file with the extension BND. This data file consists of one data block, which contains half life data for shorelines. The program asks whether to create this data file or not by displaying the following on the screen:

```
---------------------------------------------------------------------------
This segment of the program creates the file with the extension BND.
(This file contains shoreline half-life data.)

Would you like to proceed in this section? (If you enter No, this data file
will not be created.) ( Y / N ) :
---------------------------------------------------------------------------
```

If you wish to create or change this data file hit 'Y' or else hit 'N'.

Instructions for Creating Subsection **BND**

Upon entering this subsection the screen will display:

```
-----------------------------------------------------
Half life designation for shores:  range no.  1
Shore number
1 = lower river
2 = upper river
3 = lower island
4 = upper island
Enter shore number code ( 1 / 2 / 3 / 4 ) : [ 0 ]
-----------------------------------------------------
```

First you have to select the shore number. There is a default value in brackets that follow the question. Just hit the return key to accept the default value. If a different value is desired, type in the new value and then hit the return key. When you answered this question, IPROCD will ask for the beginning and ending boxes for this range by displaying sequentially:

```
-------------------------------------------------------------------
What is the beginning box no. for this range?
What is the ending box no. for this range?
What is the half life code to be assigned to this range (1-10)?
-------------------------------------------------------------------
```

To answer these questions, type in the number and hit the return key.

Once the answering to these questions are completed, a summary as shown in the following will appear on the screen for verification:

```
---------------------------------------------------------------------------
Half life designation for shores: range No.  1
Shore number 2 upper river
Half life designation to shore limits in x direction (Grid Box numbers)
Begins at 21, ends at 34
The half life code assigned to this range:  4
Is the above information correct?  ( Y / N )
---------------------------------------------------------------------------
```

If the information that was entered is not correct, hit the 'N' key to prompt the series of questions again. If the information is correct, hit the 'Y' key. The program then asks if you would like to create data for another shoreline region. The question is as follows:

```
---------------------------------------------------------------
Do you wish to create another range of grid boxes?  ( Y / N ) :
---------------------------------------------------------------
```

If you hit the 'Y' key the previous set of questions will be repeated and you can create shoreline data for another range of grid boxes. If this is not desired, hit the 'N' key.

At this point the data file for this subsection has been created and saved. The following will appear on the screen:

```
-----------------------------------
File STCL11.BND has been saved.
Hit any key to continue.
-----------------------------------
```

Subsection LAKEWIND.DAT

This subsection is needed only when you intend to run LROSS. If you are creating data for ROSS, the program will skip this section.

This subsection contains meteorological data used by the lake circulation

model and has one block of data. There may be a maximum of 25 wind stations per time interval. If this subsection is entered, the following will appear on the screen:

```
---------------------------------------------------------------------------
This segment of the program generates the data file LAKEWIND.DAT
(This will be used in the lake circulation model.)

Would you like to proceed in this section? (If you enter No, this data file
will not be created.)  ( Y / N ) :
---------------------------------------------------------------------------
```

If you wish to create or change this data file hit 'Y' or else hit 'N'.

Instructions for Creating Subsection **LAKEWIND.DAT**

IPROCD enters this subsection only if you have indicated at the beginning that you wish to create data for LROSS.

Upon entering this subsection the following eight (8) questions will be asked sequentially:

```
---------------------------------------------------------------------
The time at which the wind observation is made is (hrs.) ?
The latitude of wind observation point is (deg. north) ?
The longitude of wind observation point (deg. west)?
The height of instruments is (ft.)?
The temperature of air is (deg. F)?
The temperature of water is (deg. F)?
The wind speed is (mph)?
The wind direction is (deg. Clockwise)?
---------------------------------------------------------------------
```

The answer to the first question is the time elapsed after the oilspill began. Type in the value and then hit the return key.

The second and third questions are to determine the latitude and the longitude of the wind observation point. To answer these questions type in the appropriate values followed by the return key.

The fourth question is to find the height of wind observation instruments above the water surface. Questions five to seven are self explanatory. The

last question asks for the wind direction. This is the clockwise angle from north in degrees (e.g. wind out of west = 270°). Answer these questions by typing in the appropriate value and hitting the return key.

Once the answering to this series of questions is completed a summary will be displayed as follows (the numbers shown below are for a sample case):

```
---------------------------------------------------------------
The time of observation is:  hr 3.00
The latitude of wind observation point is:  44.00 deg North
The longitude of wind observation point is:  71 deg East
The height of instruments is:  10.00 ft
The temperature of air is:  40.00 deg. F
The temperature of water is: 60.00 deg. F
The wind speed is: 5.00 mph (7.33 ft/sec)
The wind direction is: 90.00 deg
Is the above information correct?  ( Y / N ) :
---------------------------------------------------------------
```

If any of the data in the above display needs to be changed hit 'N' key. If the above display is correct, hit 'Y' key to proceed. At this point, you will have the option to enter wind data for another station for the same time or the same station at a different time, or terminate entering wind data. The following question will appear on your screen:

```
-------------------------------------------------------------------------
Would you like to enter data for another wind station or another time step?
( Y / N ) :
-------------------------------------------------------------------------
```

If you hit 'Y' key you can create a similar set of data that corresponds either to a different station or a different time. If you would like to terminate data entry, hit 'N' key.

All of the data for this file has now been entered and saved. The following will appear on the screen:

```
------------------------------------
File LAKEWIND.DAT has been saved.
Hit any key to continue.
------------------------------------
```

At this point hit any key to continue with the program.

II.3 Defining Filenames and Unit Numbers

At this point in the program all but one data file have been created. This last data file[2] contains all the data file names and unit numbers that will be used in the oilspill simulation models. If you have created data files in this section, their filenames will be used automatically by this program. These file names cannot be changed for this last datafile. Names of all other data files which were not created during this session may be specified at this time.

The first file name is for the geometric data file. The geometric data for each of the rivers and lakes have already been setup. You only need to choose one from the list provided. For this file assignment the following will appear on the screen:

```
------------------------------------------------------------------------
Individual datafiles created (if any) during the session have been saved.
Now we are going to set up the file specification for corresponding unit
numbers.  [Unit numbers will be assigned by the program.  You need to specify
only the file names.]

For obtaining the geometric data file, please hit the number of the
corresponding river/lake:

1 - St. Clair River
2 - Detroit River
3 - Upper St. Mary's River
4 - Lower St. Mary's River
5 - Lake St. Clair and Detroit River
------------------------------------------------------------------------
```

[2] For advanced user: The name of this file is either ROSS.FNM or LROSS.FNM depending on whether you are creating data for ROSS or LROSS.

To answer this question, just hit the number corresponding to the river or lake that you wish to simulate. The program will automatically assign the appropriate geometric data filename.

After answering this question, questions will appear on the screen for data files with extensions SPL, BND, FLW, and ICE. If a data file was created during the execution of this program, no question for that file will appear.

The first question asks for the filename of the data which has the extension of SPL. The following will appear on the screen for this question:

```
------------------------------------------------------------
For the file with the extension SPL, enter the 6 letter name:
(This file contains oilspill data) [STCL11]
------------------------------------------------------------
```

To answer this question, either hit the return key to accept the filename in the brackets or type in a different filename and then hit the return key.

The second question asks for the filename of the data which has the extension of BND. The following will appear on the screen for this question:

```
------------------------------------------------------------
For the file with extension BND, enter the 6 letter name:
(This file contains shoreline data) [STCL11]
------------------------------------------------------------
```

To answer this question, either hit the return key to accept the filename in the brackets or type in a different filename and hit the return key.

The third question asks for the filename of the data which has the extension of FLW. The following will appear on the screen for this question (Note that a set of 15 flow datafiles have been created for the convenience of the user. You may choose any one of these or any of your own flow data.):

For the file with the extension FLW, enter the 6 letter name.
The default filenames for low, medium and high flow are as follows:

	HIGH FLOW	MEDIUM FLOW	LOW FLOW
St. Clair River	STCHHI Q = 230,000	STCLME Q = 188,000	STCLLO Q = 130,000
Detroit River	DETRHI Q = 210,000	DETRME Q = 184,000	DETRLO Q = 170,000
Upper St. Mary's River	STMUHI Q = 110,000	STMUME Q = 76,000	STMULO Q = 57,000
Lower St. Mary's River	STMLHI Q = 110,000	STMLME Q = 76,000	STMLLO Q = 57,000
Lake St. Clair & Detroit River	LDETRHI Q = 210,000	LDETRME Q = 184,000	LDETRLO Q = 170,000

If you choose from this table, enter the corresponding 6 letter name in the table above the flow discharge number [STCL11]

This table shows the river or lake and three possible flow conditions. There are default files which contain the data for these flow conditions. The default filenames are above the discharge volume for the flow condition of the river or lake.

For example, the default file name for the Lower St. Mary's River with a flow condition of about 76,000 cfs is found as follows:

1 - Find the river or lake in the left column

2 - Go to the right in that row and find the closest Q value.

3 - The default filename is just above this value.

For this example the closest Q value is 76,000 cfs. This is the medium

flow condition. The default filename for this value is STMLME.

For the default filename, type in the filename and then hit the return key. Otherwise, type in a different desired filename and then hit the return key.

The fourth question asks for the filename of the data which has the extension of ICE. The following will appear on the screen for this question:

```
------------------------------------------------------------
For the file with the extension ICE, enter the 6 letter name:
(This file contains areal coverage of ice).  [STCL11]
------------------------------------------------------------
```

To answer this question, either hit the return key for the filename in the brackets or type in a different filename and then hit the return key.

After answering this series of questions, the following message will appear on the screen:

```
------------------------------------------------------------------
The data creation program is now complete.  Hit any key to continue.
------------------------------------------------------------------
```

The creation of data files is now complete for ROSS. The program will return to the main menu if you hit any key.

If you choose to create datafiles for LROSS, one more data filename needs to be assigned. This data file is LAKEWIND.DAT. After this is done, the program will return to main menu if you hit any key.

II.4 Output Files of ROSS/LROSS

The output files always have the same name regardless of the run. These file names are:

OILPRT.OUT
VELCAR.OUT
VELSTR.OUT
XXXXSP.OUT

OILPRT.OUT file contains the geometric data and shoreline data. This file is not generated unless you have selected this option from the menu during the creation of SPL file.

VELCAR.OUT and VELSTR.OUT are files that contain the information on velocity distribution. ROSS and LROSS programs are capable of producing these files, but you cannot do this from interactive mode. Consult the ROSS and LROSS manual for details.

XXXXSP.OUT is the datafile that contains the information needed to produce graphical output. XXXX is the abbreviated name for the river. For example, the output file for St. Clair River will always be STCLSP.OUT. Other four names are DETRSP.OUT, STMUSP.OUT, STMLSP.OUT and LDETRSP.OUT. As you can see the filename is based on the river. Therefore, when you make several runs normally you will be left with only the datafile that corresponds to the latest run and the previous output file generated will be lost.

Suppose you need to save all the output datafiles that corresponds to each run. You can do so by going to the system level and then using the copy command. The syntax for this command is:

```
COPY filename1 filename2
```

You should not use the Rename command to change names in this case. You can also delete unwanted files by using Delete command from the system level. The syntax for this command is "DEL filename". Use this command carefully.

CHAPTER III

MENU FOR THE GRAPHICS PROGRAMS

This chapter supplements the information available on the screen for running the graphics menu. First, the standard notation used within the graphics program need to be explained. A value listed in angle brackets ("<" and ">") in a question is the default value. If you just hit the "ENTER" key instead of typing in a value, then the default value will be used. For example, "Enter Y - max <80120>?" indicates that the default y-max value is 80120 ft. If you would like to use this value, hit "ENTER". Otherwise, type in the desired value and then hit "ENTER".

III.1. Graphics Menu

Upon entering the graphics menu the screen display will show:

```
---------------------------------------
1) St. Clair River
2) Detroit River
3) Lower St. Mary's River
4) Upper St. Mary's River
5) Lake St. Clair and Detroit River
6) Exit - Return to Main Menu

  Select option number and then hit return:? 1

---------------------------------------
```

In response to this menu, enter the number that corresponds to the river/lake that you would like to see plotted and hit "ENTER". The next question the computer will ask is:

```
-------------------------------------------------------------------
What oil spill file would you like to look at <STCLSP.OUT> ?
-------------------------------------------------------------------
```

You should enter the filename which corresponds to the case that you would

like to plot. The default file name you see on the screen will be one of the following: STCLSP.OUT, DETRSP.OUT, STMUSP.OUT, STMLSP.OUT or LDETRSP.OUT, depending on your answer to the previous question. These names correspond to the latest output file created by ROSS/LROSS for the particular river. If the default name is acceptable, just hit "ENTER". If you would like to view the result of an earlier run, then you should enter the name of the output file that corresponds to that run.

After the oil spill file is supplied you are in the main graphics program.

Initial Options

There are several parameters that can be defined so that a plot can be adjusted to suit the user's requirements. There are many parameters the user has to supply to control the form of the plot. These include the area of the river or lake that you would like to see plotted, the time levels at which the oil slick is to be plotted, the labels, monochrome or color output, plotter or screen output, single display or sequential display of oil slick, or multiple time levels on one display or plot.

There is a file on disk which contains the default values for X-min, Y-min, X-max, and Y-max. These values are the X and Y coordinates of the lower left hand corner and the upper right hand corner of the screen respectively. Later in the program you have the option of changing these values if you desire.

Plotting Area

The program will first display the last saved values for X-min, Y-min, X-max, and Y-max. The program will ask you if you would like to change these values (the scale) by displaying, for example:

```
---------------------------------------------------------------------

The plotting area is currently defined by:
     X-min : 1000
     X-max : 100000
     Y-min :-20000
     Y-max : 82810

You  have the option to change the scale after you have seen the plot by using
the arrow keys or the 'C' key.
Would you like to change the scale < N > ?

---------------------------------------------------------------------
```

The default answer is "No". If you would like to change these values, answer "Y" to the question. You will then be asked to enter the values for each of the variables. If you do not want to change a particular value, just hit "ENTER". If you answer "Y" to this question you will be prompted to enter the four values X-min, Y-min, X-max, and Y-max by displaying the following questions sequentially.

```
-----------------------------------------------------

     Enter X-min  < 1000 >  ? 70000
     Enter X-max  < 100000 >  ? 94000
     Enter Y-min  < -20000 >  ? 4000
Suggested values for Y-max are:
     18595 for no distortion on screen
     20560 for no distortion on plotter
     or 82810 , the data-file default
     Enter Y-max  < 82810 >  ?

-----------------------------------------------------
```

After you enter the first three values, some information will be displayed on the screen to help you select a value. The distorted plots are computed based on the physical size of the screen and paper plot.

Time Steps

The next question is to specify the number of time steps for which the oil slick is to be plotted. This question is displayed as follows:

```
-----------------------------------------------------------------

Please enter the number of time-steps you would like to see --
 (Enter -1 to see all time-steps or 0 to see just the river boundary)
Number of steps ? 3

-----------------------------------------------------------------
```

Suppose you answered this question by typing 3 and then return. Questions will be prompted for you to specify time levels at which you would like to have the oil slick plotted. The screen display will be:

```
---------------------------------

Please enter step number :? 1
Please enter step number :? 2
Please enter step number :? 3

---------------------------------
```

In the above displayed case, the user has specified the step numbers 1, 2 and 3. The time that correspond to these steps will depend on the time step of the oil spill model and time step frequency at which the data was written to the datafile XXXXSP.OUT. For example, if the time step in the oil spill model was 15 minutes, and data was written to XXXXSP.OUT datafile every time step, steps 1, 2 and 3 represent 15 min., 30 min. and 45 min., respectively, after the spill. On the other hand, for a 15 minute time step, if the data was written every 4 time steps in ROSS/LROSS, the step number 1, 2 and 3 in the graphics program represent 15 min., 1 hr. 15 min., and 2 hrs. 15 min. In any case, the real time will appear at the bottom of the plot, both on the screen and on the plotter. It is not necessary that the step numbers will be consecutive. You may skip steps by specifying, for example, 4, 7 and 13. However, the steps must be in increasing order, i.e., you may not request step number 4 and then step number 1.

There are two special values that you may find useful: a value of 0 will show only the shoreline and labels (if selected in later questions), and a value of -1 will display all the time steps.

Plot Type

The next question is whether you would like to see the plot in monochrome or color. The monochrome plot represents the oil slick as an assembly of particles whereas the color plot can show the distribution of oil according to various concentrations. The screen display for this question would be:

Which would you like to see: Monochrome or Color?
Enter M or C < M > ?

You can answer this question by typing C or M.

Multiple Plots

If you requested to see more than one time step, the program will ask you if you would like to have multiple time steps plotted on the same plot by displaying:

Would you like to see multiple plots on the same graph < N > ?

If you want more than one time step to appear on the same screen, answer "Y". If you would like to see each plot on a separate screen (or paper), type "N". The default is "N".

If you answer "Y" (indicating that there can be more than one time step on the same screen), there is another option you may select later to control how your plot looks on the screen. With this option you may clear all

previous steps on the screen and re-plot the current step. Details for this option are given in the section on Further Options.

Geographic Locations

The next question is whether you would like to see geographic locations and their labels marked on your plots. The screen display for the question is

---

Do you want geographic locations and labels to appear < N > ?

You may answer with "Y" or "N" followed by return. The default is "N" and you may accept it by just hitting return. If you are plotting the entire river in one plot, choosing this option may make the plot too crowded with labels in some areas.

Mile Markers

This question is to determine whether you would like to see the river mileage markers and their labels on your plot. The screen display for this question is:

Do you want mile markers and labels to appear < N > ?

Again, you may answer with "Y" or "N" followed by return. The default is "N" and you may accept it by just hitting return.

Plotter

The last question the program will ask at this stage is whether you would like to send the plot to the plotter. The default is "No". If you want a copy on the plotter, please make sure that the plotter is turned on now (for plotter information see the section on plotter operation in this manual). The

screen display for this question is:

Do you want a plotter output < N >?

Again you may answer with "Y" or "N". The default value is "N" and you may accept it by just hitting return.

Plotting Process-Monochrome

If you have selected monochrome plot no more questions will be asked before the program starts plotting. It takes a few minutes for the computer to read all the data and process before it starts plotting. It is best not to do anything with the keyboard during this time period. If you have selected more than one step to be plotted the computer will pause after it finishes plotting the first step. You can hit any key to continue. Any time you are in Pause, there are a few additional options that you can execute to control the way the plot will look. Refer to the section under Further Options for more details on these additional options. Fig. 3 is a sample output from a monochrome plot.

Data Processing and Plotting-Color

If you selected the color option more questions will be asked to determine the color classification. There will be approximately a 2 minute delay between the last question you answered and the next screen display. It is best not to use the keyboard during this period. There are 8 colors available for the classification for both the screen option and the plotter option. Therefore, you need to specify the upper range for each color. Initially the program computes a linear classification based on the total volume available for the first time step to be plotted.

A sample display for a spill step containing 10,000 gallons is shown below.

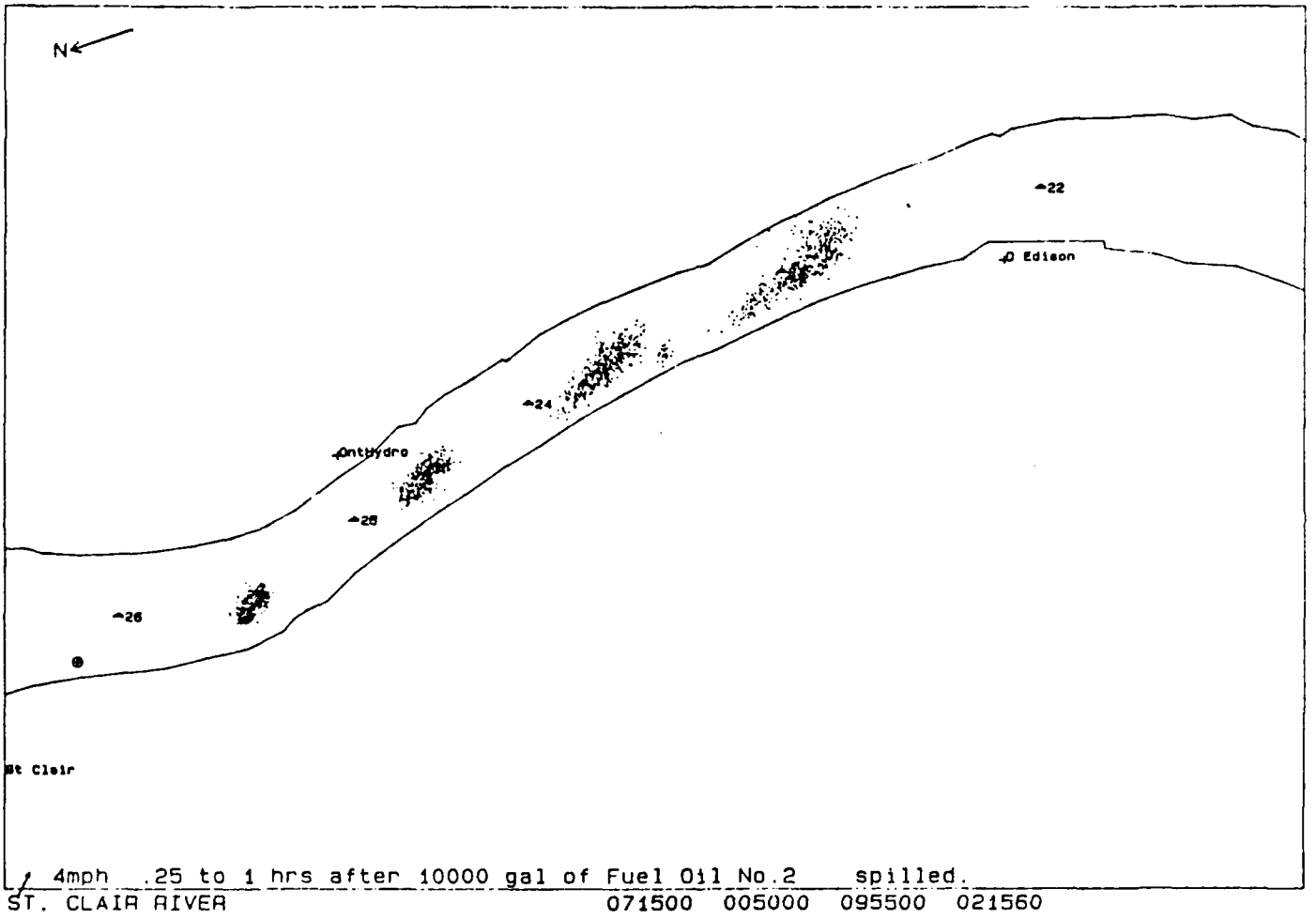


Figure 3. A Monochrome Plot for an Instantaneous Spill in St. Clair River

```
-------------------------------------------------------------------------

Color Classification:
     500 Patches,       20 Gal/Patch,      10000 Gal Total,   12 Boxes
       6 boxes with           1.0 -         200.0 gallons
       0 boxes with         201.0 -         400.0 gallons
       2 boxes with         401.0 -         600.0 gallons
       0 boxes with         601.0 -         800.0 gallons
       0 boxes with         801.0 -        1000.0 gallons
       0 boxes with        1001.0 -        1200.0 gallons
       1 boxes with        1201.0 -        1400.0 gallons
       3 boxes with        1401.0 -       10000.0 gallons

Would you like to change the Color Classifications < N > ?

-------------------------------------------------------------------------
```

The default answer is "N" which you can accept by just hitting return. If you typed "Y" you will be prompted to answer the following question sequentially.

```
-------------------------------------------------------------------------

Please enter the cut-off points for the color classifications.
Make sure that you type them in an ascending order:

Old value:    200.0  New value :? 50
Old value:    400.0  New value :? 100
Old value:    600.0  New value :? 150
Old value:    800.0  New value :? 200
Old value:   1000.0  New value :? 300
Old value:   1200.0  New value :? 350

-------------------------------------------------------------------------
```

The values shown after the question mark are for a sample case. After you enter the last value the computer will take a few seconds to re-process the Color Classification and then it will display the new classification as:

```
Color Classification:
     500 Patches,      20 Gal/Patch,     10000 Gal Total,    12 Boxes
       3 boxes with          1.0 -       50.0 gallons
       1 boxes with         51.0 -      100.0 gallons
       0 boxes with        101.0 -      150.0 gallons
       2 boxes with        151.0 -      200.0 gallons
       0 boxes with        201.0 -      300.0 gallons
       0 boxes with        301.0 -      350.0 gallons
       0 boxes with        351.0 -      400.0 gallons
       6 boxes with        401.0 -    10000.0 gallons

Would you like to change the Color Classifications <N>?
```

The procedure to answer this question is the same as before. You can continue with this process until you are satisfied with the color classification. If you answer "N" to this or just hit return, the computer will go into the plotting mode. After one step is plotted the computer will pause until you hit any key. There are additional options that you can execute during this pause mode. Refer to the section on Further Options for details on these additional options. If you selected multiple plots the same color classification will be maintained from step to step to maintain the consistency. Figs. 4 and 5 show a sample color plot. It should be mentioned here that the total spill volume may not be the same from step to step due to evaporation and dissolution.

At the end of the plotting session, questions will be asked to determine if you need more plots of this spill. You may answer with "Y" or "N" to these questions. These questions are self-explanatory.

Further Options

In addition to the options that were discussed, the program allows some further options. It is not necessary to know these options in order to run

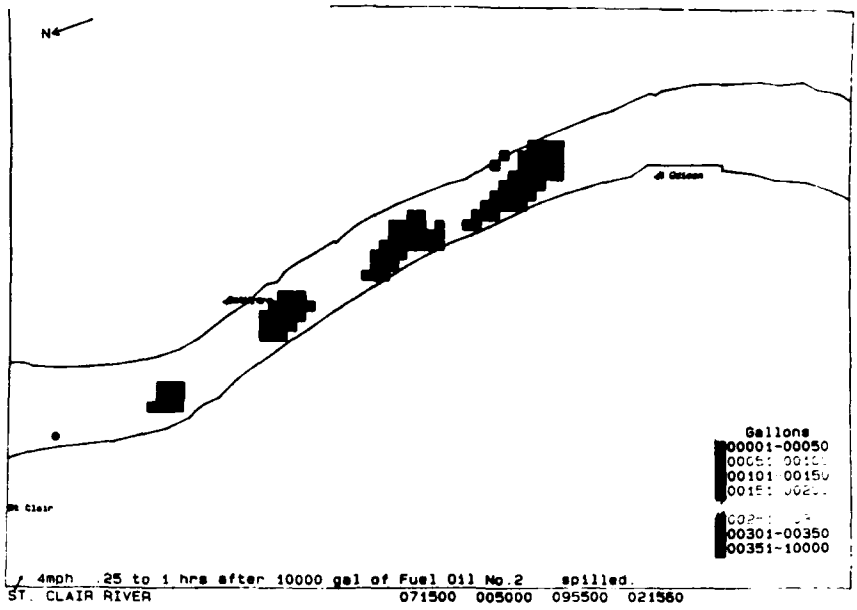


Figure 4. A Color Plot for an Instantaneous Spill in St. Clair River

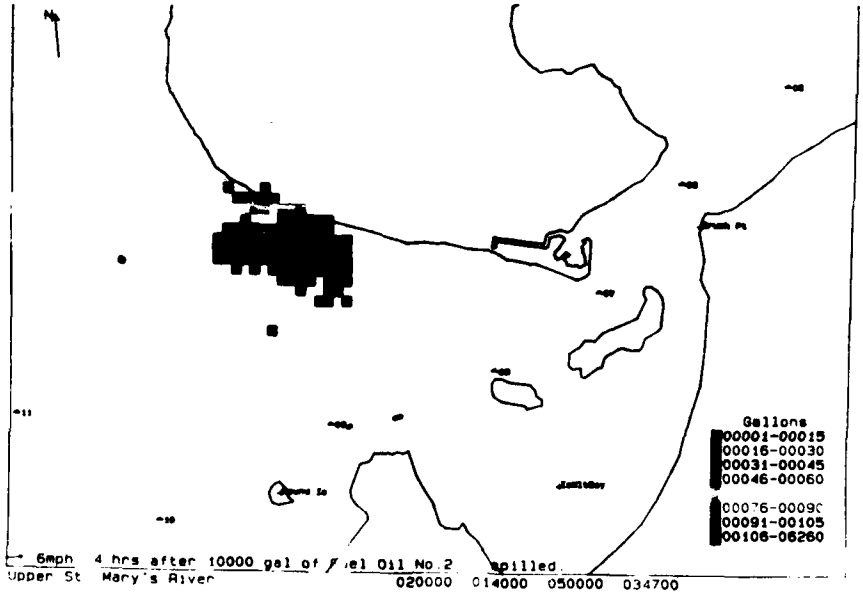


Figure 5. A Color Plot for a Continuous Spill in Upper St. Mary's River

the program. However, they give more flexibility to control the output.

The program will plot one time step of the requested plot and display a message at the bottom of the screen indicating that the program is pausing and that you should hit a key to continue. This is considered the pause mode. There are several options available at this level to present the plot in different forms.

For this section of the program to operate correctly you must make sure that the "numlock" light on the upper right hand side of the keyboard is on. If it is not on, you can turn it on by hitting the "numlock" key on the upper right hand side of the keyboard.

If you would like to save the current X-min, Y-min, X-max, and Y-max values, hit "S" when you are in the pause mode. This saves those values in the default value file. The advantage here is that if you plan to make many plots with the same window, you do not need to specify them for each time once the values are saved.

To exit the program hit "Q" for quit.

To clear the display and have the last time step re-plotted, hit "Home" (which is the "7" key on the numeric keypad). You can use this feature to erase unwanted plots on the screen.

If you would like to change the X-min, Y-min, X-max and Y-max values, hit the "C" key. The program will then prompt you for new values and re-plot the last time step. This option can also be used to zoom in and zoom out. Generally, the next option is easier for zooming in. Therefore, "C" option is usually used for zooming out.

Zooming

If you would like to zoom in on the plot (to enlarge the spill area on the plot), just use the arrow keys located on the numeric keypad. When you hit an arrow key for the first time a cross-hair cursor will appear at the

center of the screen. This cross-hair has a light green color. You may move this cursor with the arrow keys. Move this cursor to the upper right hand corner of the area you would like to see enlarged. When you have the cursor at the position that you desire, hit "ENTER". When you hit "ENTER" you will see a violet color cursor permanently marked at that position. You will also see another light green cross-hair cursor appear at the center of the screen. Move this cursor to the lower left hand corner of the area that you would like to see enlarged. These two cursors form an imaginary rectangle around the area to be zoomed in on. When you have the second cursor in the appropriate position, hit "ENTER".

The program will clear the screen, zoom in on the area specified and re-plot the last time step. Note that when you zoomed in you changed the X-min, Y-min, X-max, and Y-max values.

Finding X,Y Coordinates of a Point

When you move the cross-hairs during the zooming option you will notice that the numeric values that correspond to X-min, Y-min, X-max, and Y-max at the bottom of the screen changes. Therefore, this feature can be used to determine the coordinates of a spill location. In the first instance you will realize that your resolution is limited because the cursor moves a fixed distance for each hit of the cursor key. However, you can improve the resolution by zooming in and re-locating the point until the required accuracy is achieved.

Brief Explanation of the Plots

Referring to Figs. 3, 4 and 5, some of the descriptions shown on the plots will be explained here. On the top left corner you will see an arrow and an "N". This indicates the magnetic north. On the bottom left corner you will see a small arrow. This shows the direction of the wind. These arrows show the correct direction only if the plotting scales are undistorted (i.e.

Y-scale = X-scale). Next to the wind direction arrow wind speed is printed in mph. The time that corresponds to the spill stage shown are also printed on that line. If you plot more than two time steps, only the time that corresponds to the first and last step will appear on the plot. This was enforced to keep the descriptions on the plot to a desired level. In addition, there are four numbers that appear below the margin. These numbers represent the coordinates of the limits of your current viewing area in feet. The sequence is X-min, Y-min, X-max, Y-max.

The spill site is indicated by a circle with cross-hairs "O". In the color plot mode the physical size of the color blocks can be determined by the following formulas:

X = (X-max - X-min) * 0.011 (ft)

Y = (Y-max - Y-min) * 0.0174 (ft)

A summary of commands to be used in the Pause mode is given in Table 1.

Table 1. Summary of Commands to be Used in the Pause Mode

These are the commands that can be used when the program pauses with a plot on the screen: (Remember that you must make sure that the "numlock" light on the upper right hand side of the keyboard is on.)

Arrows	Zooming features
C	Allows you to enter new values for X-min, Y-min, X-max, Y-max
Home	Clear the screen and replot last time step
Q	Quit
S	Save X-min, Y-min, X-max, Y-max in default value file.

III.2. Using the Plotter

To use the plotter, make sure that it is turned on. The power switch is on the back of the machine near the left rear corner. You will be able to hear the fan when the machine is turned on. The program is written and the computer is interfaced for HP7550 plotter. Other HP7000 series plotters may also work successfully.

Paper

There are two ways to load paper into the plotter. The first and easiest way is to remove the paper tray in the front center portion of the machine by pulling it firmly. This paper tray is much like a photocopier paper tray. Fan the edge of the paper, place into the paper tray, then push the paper tray back into place on the machine. Set the paper feeder to Automatic by pressing the "AUTO/LOAD" button on the plotter until a "*" appears in the upper right hand corner of the plotter display. Now you can automatically load paper just by hitting the "LOAD/UNLOAD" button on the plotter.

The second way is to load paper manually. Place a sheet of paper under the rollers in the center of the plotting surface. Make sure that the paper is flush against the left hand side of the plotting surface. Press the "LOAD/UNLOAD" button on the plotter. The plotter will grab the paper and move it into place.

Pens

To load pens into the plotter, flip up the hinged smoked plastic lid. On the right hand side of the plotting surface in a small well is the plotting carousel. Lift the carousel by gently pulling down on the plunger directly under the carousel position that you are loading. Slide the pen into the carousel and gently release the plunger. When you have loaded all eight carousel positions, put the carousel back into the small well you got it from. Lower the hinged cover. The plotter may ask you to hit the enter

button on the plotter before it will plot. If it does, just hit the "ENTER" button on the plotter.

Problems

If you have any problems with the plotter, consult the two plotter manuals.

APPENDIX I

HARDWARE AND SOFTWARE REQUIREMENTS

For all elements of the program to work it is necessary to have the following hardware: (i) an IBM PC-AT with 640k memory, (ii) a Tecmar[1] Grahpics card, (iii) high resolution monitor, (iv) HP 7550 plotter, (v) a printer, (vi) HALO[2] graphics subroutine package, (vii) BASICA software. However, most of the elements will run on IBM PC compatible machine. There are parts of the program that will not work if certain requirements are not available. These requirements are:

1. If HALO is not available, the graphics part of the program will not work.
2. If HP plotter is not available everything else will work except that hardcopies of plots cannot be obtained.
3. If instead of Tecmar graphics card your machine has a different grahpics card, you have to change a few things in the program. This is not difficult since HALO supports many different graphics cards. However, it is necessary that your graphics card has at least 640 x 400 resolution. Otherwise, you may have to change a few more statements in the BASIC program.

---

[1] TECMAR is the trademark of Tecmar, Inc.

[2] HALO is the trademark of the Media Cybernetics Co. Software rights must be obtained before installing this program on your machine.

APPENDIX II

PRORGAM LISTING

This appendix contains the listing of BASIC programs used in the interactive microcomputer version of the oil spill models. Fortran programs and sample data files are given in Volumes II and III. The BASIC programs presented in this appendix are:

ITDOS.BAS

PREMOSS.BAS

MOSS.BAS

IPROCD.BAS

IPROGR.BAS

IPROGR.OVR

Program ITDOSS BAS

```
100 '*************************************************************************
*
110 '*
*
120 '*                          ...ITDOSS.BAS...
*
130 '*
*
140 '*        THIS PROGRAM IS THE INTRODUCTION, TITLE AND DISCLAIMER
*
150 '*                      FOR THE OILSPILL PROGRAMS
*
160 '*
*
170 '*
*
180 '*
*
190 '*************************************************************************
*
200 CLS : CLEAR : KEY OFF
210 '*************************************************************************
*
220 '                  THE FOLLOWING SECTION IS THE DISCLAIMER
230 '*************************************************************************
*
231 COLOR 15,1:PRINT"
                    ":PRINT"                                    OILSPILL SIMULATION M
ODEL
                                    "
232 PRINT"                                        ( ROSS / LROSS )
          "
233 PRINT"
          ":COLOR 10,0
240 PRINT"+-----------------------------------------------------------------
----------+"
250 PRINT"|     Developed by the Department of Civil and Environmental Enginee
ring,      |"
260 PRINT"|                  Clarkson University,  Potsdam, New York 13676
          |"
270 PRINT"|      under the support of the Detroit District, U. S. Army Corp of
          |"
280 PRINT"|      Engineers, through the Cold Regions Research and Engineering
          |"
290 PRINT"|      Laboratory, Hanover, N.H.
          |"
300 PRINT"+-----------------------------------------------------------------
----------+"
330 PRINT"          This program is furnished by the Government and is accepte
d and used "
340 PRINT"by the recipient upon the express understanding that the United Stat
es          "
350 PRINT"Government mak  no warranties, express or implied, concerning the a
ccuracy,    "
360 PRINT"completeness, reliability, usability, or suitability for any particu
alr purpose"
```

```
370 PRINT"of the information and data contained in this program or furnished i
n          "
380 PRINT"connection therewith, and the United States Gouvernment shall be und
er no      "
390 PRINT"liability whatsoever to any person by reason of any use made thereof
. The      "
400 PRINT"program herein belongs to the Government.  Therefore, the recipient
further    "
410 PRINT"agrees not to assert any proprietary rights therein or represent thi
s program  "
420 PRINT"to anyone as other than a Government program.
           "
430 PRINT"
           "
440 PRINT"
           "
460 PRINT"                              Hit any key to continue.
           ";
470 A$ = INKEY$ : IF A$ = "" THEN 470
475 COLOR 15,1
480 RUN"PREMOSS.BAS"
490 END
```

Program PREMOSS BAS

```
1000 '*************************************************************************
**
1010 '*
 *
1020 '*                          ...PREMOSS.BAS...
 *
1030 '*
 *
1040 '*        THIS PROGRAM IS THE MAIN MENU FOR THE OILSPILL PROGRAMS
 *
1050 '*
 *
1060 '*
 *
1070 '*
 *
1080 '*************************************************************************
**
1090 CLS : CLEAR
1100 PRINT"LROSS requires a large amount of memory.  Therefore LROSS cannot be
 run while   graphics programs are in memory.  This is a limitation due to the
 available     memory for IBM PC-AT."
1110 PRINT"  If graphics programs are loaded the machine has to be switched of
f and         switched on to run LROSS.  You should therefore, now select wheth
er you want to run LROSS or the other options";
1120 PRINT" [ ROSS, Graphics, Interactive Data Creation ]."
1130 PRINT:PRINT"          This is the PRE-MENU for the Oilspill Simulation Pro
grams."
1140 PRINT
1150 PRINT"NOTE: LROSS is for Lake St. Clair and Detroit River"
1160 PRINT
1170 PRINT"       ROSS is for:  ST. Clair River"
1180 PRINT"                      Detroit River"
1190 PRINT"                      Upper St. Mary's River"
1200 PRINT"                      Lower St. Mary's River"
1210 PRINT"
1220 PRINT"1 - Continue to MAIN MENU
1230 PRINT"2 - LROSS with output on the screen
1240 PRINT"3 - LROSS with output on the printer
1250 PRINT
1260 PRINT"At 'C>' hit the number (1, 2 or 3) and then hit <ENTER>"
1270 SYSTEM
```

Program MOSS BAS

```
100 '*************************************************************************
*
110 '*
*
120 '*                          ...MOSS.BAS...
*
130 '*
*
140 '*       THIS PROGRAM IS THE MAIN MENU FOR THE OILSPILL PROGRAMS
*
150 '*
*
170 '*
*
180 '*************************************************************************
*
190 COLOR 15,1 : CLS : CLEAR
200 PRINT"          This is the MAIN MENU for the Oilspill Simulation Programs.
"
210 PRINT
220 PRINT"NOTE: LROSS is for Lake St. Clair and Detroit River"
230 PRINT
240 PRINT"       ROSS is for:  ST. Clair River"
250 PRINT"                      Detroit River"
260 PRINT"                      Upper St. Mary's River"
270 PRINT"                      Lower St. Mary's River"
280 PRINT"
290 PRINT"1 - Create data files    {IPROCD.BAS}
300 REM PRINT"2 -" : REM LROSS with output on the screen
310 REM PRINT"3 -" : REM LROSS with output on the printer
320 PRINT"2 - ROSS with output on the screen
330 PRINT"3 - ROSS with output on the printer
340 PRINT"4 - Graphic Routines    {IPROGR.BAS}
350 PRINT"5 - Exit
360 PRINT
370 PRINT"Hit the number of the desired option:
380 A$ = INKEY$ : IF A$ = "" THEN 380
390 IF A$ = "1" THEN RUN"IPROCD.BAS"
400 REM IF A$ = "2" THEN 470
410 REM IF A$ = "3" THEN 490
420 IF A$ = "2" THEN 510
430 IF A$ = "3" THEN 530
440 IF A$ = "4" THEN RUN"IPROGR.BAS"
450 IF A$ = "5" THEN SYSTEM
460 BEEP : GOTO 380
470 REM SHELL"SLROSS.BAT"
480 REM GOTO 190
490 REM SHELL"PLROSS.BAT"
500 REM GOTO 190
510 SHELL"SROSS.BAT"
520 GOTO 190
530 SHELL"PROSS.BAT"
540 GOTO 190
550 END
```

Program IPROCD BAS

```
100 '*************************************************************************
*
110 '*
*
120 '*                          ...IPROCD.BAS...
*
130 '*
*
140 '*          This is the Interactive PROgram to Create Data files
*
150 '*                    for the Oilspill Simulation models
*
160 '*
*
170 '*
*
180 '*
*
190 '*************************************************************************
*
1000 CLEAR:SCREEN 0
1010 REM ************************************************************************
*
1020 REM      ROSS AND LROSS DATA CREATING PROGRAM
1030 REM ************************************************************************
*
1130 COLOR 15,1 : CLS
1140 PRINT"     This program interactively creates the input data files necessa
ry to run                                    the Fortran programs ROSS and LROSS.":P
RINT
1150 PRINT"              Enter the first 6 characters which defines the filename
 .":PRINT"         The unit numbers will be automatically assigned by the progr
am." :COLOR 10,1:LINE INPUT"> ";FILENAME$:COLOR 15,1
1151 RESTORE
1152 FOR I = 1 TO 60
1153    READ A$
1154    IF FILENAME$=A$ THEN 1159
1155 NEXT I
1156 DATA STCL,DETR,STMU,STML,LDETR,STCLHI,STCLME,STCLLO,DETRHI,DETRME,DETRLO,
STMUHI,STMUME,STMULO,STMLHI,STMLME,STMLLO,LDETRHI,LDETRME,LDETRLO,stcl,detr,st
mu,stml,ldetr,stclhi,stclme,stcllo,detrhi,detrme,detrlo,stmuhi,stmume,stmulo,s
tmlhi
1157 DATA stmlme,stmllo,ldetrhi,ldetrme,ldetrlo,Stcl,Detr,Stmu,Stml,Ldetr,Stcl
hi,Stclme,Stcllo,Detrhi,Detrme,Detrlo,Stmuhi,Stmume,Stmulo,Stmlhi,Stmlme,Stmll
o,Ldetrhi,Ldetrme,Ldetrlo
1158 GOTO 1169
1159 PRINT:PRINT:PRINT:COLOR 12,0:PRINT"                                  * * *   W A
R N I N G    * * *                          "
1160 PRINT"
          "
1161 PRINT"                          YOU HAVE SPECIFIED A RESERVED FILENAME!
          "
1162 PRINT"
          "
1163 PRINT"  CONTINUING WITH THIS NAME MAY CAUSE THE DEFAULT DATA FILES TO BE
```

```
DESTROYED!    ":SOUND 500,5:SOUND 900,5:SOUND 500,5:SOUND 900,5:SOUND 500,5:SOU
ND 900,5
1164 COLOR 15,1 :PRINT: PRINT"DO YOU WISH TO ENTER A DIFFERENT FILE NAME?":LIN
E INPUT "HIT THE KEY OF THE DESIRED OPTION AND THEN HIT <RETURN>  ( Y / N )  [
Y]";A$
1165 IF A$="N" THEN 1169 ELSE IF A$="n" THEN 1169 ELSE 1130
1169 IF LEN(FILENAME$) < 7 THEN 1180
1170 PRINT:BEEP:PRINT"                    The maximum number of characters may b
e six.":GOTO 1150
1180 PRINT:PRINT"The six characters entered are : ";:COLOR 10,1:PRINT FILENAME
$:COLOR 15,1 : PRINT" Is this correct? ( Y / N )"
1190 A$=INKEY$ : IF A$="" THEN 1190 ELSE IF A$="Y" THEN 1200 ELSE IF A$="y" TH
EN 1200 ELSE IF A$="N" THEN 1130 ELSE IF A$="n" THEN 1130 ELSE BEEP:GOTO 1190
1200 PRINT:PRINT"Will these data be created for ROSS or LROSS? ( R / L ) : "
1210 FILE$=INKEY$:IF FILE$="" THEN 1210 ELSE IF FILE$="R" THEN 1220 ELSE IF FI
LE$="r" THEN FILE$="R" ELSE IF FILE$="L" THEN 1220 ELSE IF FILE$="l" THEN FILE
$="L" ELSE BEEP:IF FILE$="R" THEN 1220 ELSE IF FILE$="L" THEN 1220 ELSE 1210
1220 CLS:PRINT"This segment of the program creates the file with the extension
 SPL":PRINT"(This file contains oilspill data)"
1230 GOSUB 2000
1240 SPL$=B$ : SPLFILE$=FILENAME$+".SPL" : TEMPFILE$=SPLFILE$
1250 IF SPL$="Y" THEN GOSUB 5040
1260 IF SPL$="Y" THEN GOSUB 3000
1270 CLS:PRINT"This segment of the program  creates the file with the extensio
n FLW":PRINT"(This file contains data needed to compute flow distribution in R
iver)"
1271 PRINT:PRINT"If you want to use one of the default flow data files  (low,
medium, high flow)  you may skip this section."
1280 GOSUB 2000
1290 FLW$=B$ : FLWFILE$=FILENAME$+".FLW" : TEMPFILE$=FLWFILE$
1300 IF FLW$="Y" THEN GOSUB 7100
1310 IF FLW$="Y" THEN GOSUB 3000
1320 CLS:PRINT"This segment of the program creates the data file with the exte
nsion ICE.":PRINT"(This file contains the area coverage of ice.)"
1330 GOSUB 2000
1340 ICE$=B$ : ICEFILE$=FILENAME$+".ICE" : TEMPFILE$=ICEFILE$
1350 IF ICE$="Y" THEN GOSUB 7850
1360 IF ICE$="Y" THEN GOSUB 3000
1370 CLS:PRINT"This segment of the program creates the file with the extension
 BND.":PRINT"(This file contains shoreline half life data.)"
1380 GOSUB 2000
1390 BND$=B$ : BNDFILE$=FILENAME$+".BND" : TEMPFILE$=BNDFILE$
1400 IF BND$="Y" THEN GOSUB 8600
1410 IF BND$="Y" THEN GOSUB 3000
1420 IF FILE$="R" THEN 1510
1430 CLS:PRINT"This segment of the program generates the data file LAKEWIND.DA
T.":PRINT"(This will be used in the lake circulation model.)"
1440 GOSUB 2000
1450 LAK$=B$ : LAKFILE$="LAKEWIND.DAT" : TEMPFILE$=LAKFILE$
1460 IF LAK$="Y" THEN GOSUB 9060
1470 IF LAK$="Y" THEN GOSUB 3000
1510 CLS:PRINT:PRINT:PRINT"Individual datafiles created (if any) during this s
ession have been saved."
1520 PRINT"       Now we are going to set up the file specification for corresp
onding unit"
```

```
1530 PRINT"numbers. [ Unit numbers will be assigned by the program.  You need
to  specify"
1540 PRINT"only the file names. ]":PRINT:PRINT:PRINT
1550 PRINT"For obtaining the geometric data file, please hit the number of the
 river/lake : ":PRINT" 1 - St. Clair River ":PRINT" 2 - Detroit River ":PRINT"
 3 - Upper St. Mary's River ":PRINT" 4 - Lower St. Mary's River "
1551 PRINT" 5 - Lake St. Mary's and Detroit River "
1560 A$=INKEY$: IF A$="" THEN 1560 : A=VAL(A$) : A$=""
1561 A = VAL(A$)
1562 GEOFILE$=""
1563 IF A=1 THEN GEOFILE$="STCL"
1564 IF A=2 THEN GEOFILE$="DETR"
1565 IF A=3 THEN GEOFILE$="STMU"
1566 IF A=4 THEN GEOFILE$="STML"
1567 IF A=5 THEN GEOFILE$="LDETR"
1568 IF GEOFILE$="" THEN BEEP:IF GEOFILE$="" THEN 1560
1570 PRINT:PRINT"You have selected : ";:COLOR 10,1:PRINT A:COLOR 15,1
1580 PRINT"Is this correct? ( Y / N )"
1590 A$=INKEY$:IF A$="" THEN 1590 ELSE IF A$="Y" THEN 1650 ELSE IF A$="y" THEN
 1650 ELSE IF A$="Y" THEN 1510 ELSE IF A$="n" THEN 1510 ELSE BEEP : GOTO 1590
1650 IF SPL$="Y" THEN 1710
1660 PRINT:PRINT"For the file with the extension SPL, enter the 6 letter name
: ":PRINT"(This file contains oilspill data) ";:COLOR 10,1:PRINT USING"_[\
\_] >";FILENAME$;:LINE INPUT A$:COLOR 15,1
1670 IF A$="" THEN 1710 ELSE SPLFILE$=A$+".SPL"
1710 IF BND$="Y" THEN 1770
1720 PRINT:PRINT"For the file with the extension BND, enter the 6 letter name
: ":PRINT"(This file contains shore line data) ";:COLOR 10,1:PRINT USING"_[\
  \_] >";FILENAME$;:LINE INPUT A$:COLOR 15,1
1730 IF A$="" THEN 1770 ELSE BNDFILE$=A$+".BND"
1770 IF FLW$="Y" THEN 1830
1771 CLS:PRINT"For the file with the extension FLW, enter the 6 letter name.
                (This file contains the area coverage of ice)
                  The default filenames for low, medium and high flow are as
follows:":PRINT
1772 PRINT"                    :    HIGH FLOW    :    MEDIUM FLOW    :    LOW FLOW"
1773 PRINT"-------------------:-----------------:-------------------:-----------
---"
1774 PRINT" ST. Clair          :    STCLHI       :    STCLME         :    STCLLO
                    River      :  Q=230,000     :    Q=188,000      :    Q=130,
000":PRINT"-------------------:-----------------:-------------------:-----------
-----"
1775 PRINT" Detroit            :    DETRHI       :    DETRME         :    DETRLO
                    River      :  Q=210,000     :    Q=184,000      :    Q=170,
000":PRINT"-------------------:-----------------:-------------------:-----------
-----"
1776 PRINT" Upper St. Mary's   :    STMUHI       :    STMUME         :    STMULO
                    River      :  Q=110,000     :    Q=76,000       :    Q=57,0
00":PRINT"-------------------:-----------------:-------------------:-----------
----"
1777 PRINT" Lower St. Mary's   :    STMLHI       :    STMLME         :    STMLLO
                    River      :  Q=110,00      :    Q=76,000       :    Q=57,0
00":PRINT"-------------------:-----------------:-------------------:-----------
----"
1778 PRINT" Lake St. Clair &   :   LDETRHI       :    LDETRME        :    LDETRLO
```

```
                Detroit River  :  Q=210,000      :     Q=184,000     :     Q=170,
000":PRINT"-------------------:---------------:----------------:-----------
-----"
1780 PRINT:PRINT"If you choose from this table, enter the corresponding 6 lett
er name in the      table above the flow discharge number ";: COLOR 10,1:PRINT
USING"_[\      \_] >";FILENAME$;:LINE INPUT A$:COLOR 15,1
1790 IF A$="" THEN 1830 ELSE FLWFILE$=A$+".FLW"
1830 IF ICE$="Y" THEN 1851
1840 PRINT:PRINT"For the file with the extension ICE, enter the 6 letter name
: ":PRINT"(This file contains areal coverage of ice.) ";:COLOR 10,1:PRINT USIN
G"_[\      \_] >";FILENAME$;:LINE INPUT A$:COLOR 15,1
1850 IF A$="" THEN 1851 ELSE ICEFILE$=A$+".ICE"
1851 IF FILE$="R" THEN OPEN "O",#1,"ROSS.FNM" ELSE OPEN "O",#1,"LROSS.FNM"
1852 A$="  1"+GEOFILE$+".GEO" : PRINT #1,A$
1853 A$="  2OILPRT.OUT" : PRINT #1,A$
1854 A$="  3VELSTR.OUT" : PRINT #1,A$
1855 A$="  4VELCAR.OUT" : PRINT #1,A$
1856 IF FILE$="R" THEN 1857 ELSE A$="  5"+ICEFILE$ : PRINT #1,A$
1857 A$="  7"+FLWFILE$ : PRINT #1,A$
1858 A$="  8"+BNDFILE$ : PRINT #1,A$
1859 IF FILE$="R" THEN 1860 ELSE A$=" 10LAKEWIND.DAT" : PRINT #1,A$
1860 A$=" 11"+GEOFILE$+"SP.OUT" : PRINT #1,A$
1861 A$=" 12"+SPLFILE$ : PRINT #1,A$
1862 IF FILE$="R" THEN 1864 ELSE PRINT #1," 13LAKEBATH.DAT"
1863 PRINT #1," 14LAKEINIT.PSI" : GOTO 1865
1864 A$=" 14"+ICEFILE$ : PRINT #1,A$
1865 IF FILE$="R" THEN 1866 ELSE PRINT #1," 15LAKETEMP.PSI"
1866 CLOSE #1
1867 OPEN "O",#1,"OILPRT.OUT" : CLOSE #1
1868 OPEN "O",#1,"VELSTR.OUT" : CLOSE #1
1869 OPEN "O",#1,"VELCAR.OUT" : CLOSE #1
1870 B$=GEOFILE$+"SP.OUT"
1890 CLS:PRINT:PRINT:PRINT:PRINT"                    The data creation program is
 now complete.":PRINT: PRINT"Hit any key to continue."
1900 A$ = INKEY$ : IF A$ = "" THEN 1900 ELSE RUN"MOSS.BAS"
2000 REM ************************************************************
2010 REM  this subroutine confirms entering subroutines to create data files
2020 REM ************************************************************
2030 PRINT
2040 PRINT"Would you like to proceed in this section? (If you enter No, this d
ata file      will not be created.)  ( Y / N ) :"
2050 B$=INKEY$ : IF B$="" THEN 2050 ELSE IF B$="Y" THEN 2060 ELSE IF B$="y" TH
EN B$="Y" ELSE IF B$="N" THEN 2060 ELSE IF B$="n" THEN B$="N" ELSE BEEP:IF B$=
"Y" THEN 2060 ELSE IF B$="N" THEN 2060 ELSE 2050
2060 RETURN
3000 REM ************************************************************
**
3010 REM  this subroutine advises the user that a file has been saved
3020 REM ************************************************************
**
3030 CLS
3040 PRINT"File ";
3050 COLOR 10,1
3060 PRINT TEMPFILE$;
3070 COLOR 15,1
```

```
3080 PRINT" has been saved."
3090 PRINT
3100 PRINT
3110 PRINT"Hit any key to continue."
3120 A$=INKEY$ : IF A$="" THEN 3120
3130 RETURN
5000 REM ************************************************************************
5010 REM         this creates  the SPL file
5020 REM ************************************************************************
5030 DEFSNG A,S : COLOR 15,1
5040 B$=FILENAME$+".spl":OPEN "O",#1,B$
5050 CLS
5060 PRINT"What type of oil?"
5070 PRINT"          1 - Gasoline"
5080 PRINT"          2 - Bunker C"
5090 PRINT"          3 - Fuel Oil No.2"
5100 PRINT"          4 - Other"
5110 A$=INKEY$:IF A$="" THEN 5110
5120 IF A$="1" THEN OILNAME$="Gasoline" :GOTO 5170
5130 IF A$="2" THEN OILNAME$="Bunker C" :GOTO 5170
5140 IF A$="3" THEN OILNAME$="Fuel Oil No.2":GOTO 5170
5150 IF A$="4" THEN 5160 ELSE 5170
5160 PRINT"What is the type of oil?  ";:COLOR 10,1:LINE INPUT;OILNAME$:COLOR 1
5,1
5170 PRINT:PRINT"The oil selected is : ";:COLOR 10,1:PRINT OILNAME$:COLOR 15,1
5180 PRINT:PRINT"Is this correct? ( Y / N ) : "
5190 A$=INKEY$:IF A$="" THEN 5190 ELSE IF A$="Y" THEN 5195 ELSE IF A$="y" THEN ,
 5195 ELSE IF A$="N" THEN 5050 ELSE IF A$="n" THEN 5050 ELSE BEEP: GOTO 5190
5195 PRINT #1,OILNAME$
5200 CLS
5210 PRINT "What is the total time of oil spill simulation in hours ":COLOR 12
,1:PRINT" Note: This value must exceed the time step in unsteady flow model
           i.e in FLW   file.
5211 PRINT " If you plan to use any of the default FLW files the answer to thi
s question      must exceed 24 Hrs.  If this causes inconvenience you can creat
e FLW datafiles  with a smaller time step.  ";: COLOR 10,1:INPUT TOTIME:COLOR
15,1
5220 PRINT
5230 PRINT "What is the frequency of obtaining output from PLOTNU and other su
broutines       ie.  1' for every step,   2' for every other step. ";:COLOR 10,
1:INPUT"[1] ";A$:COLOR 15,1
5240 IF A$ = "" THEN IEVERY = 1 ELSE IEVERY=VAL(A$)
5250 PRINT
5260 PRINT "Would you like cross section geometry data and shore conditions da
ta              (Written to a separate file.)  ( 0-NO / 1-YES ) : [0] ";:COLOR
10,1:INPUT IOPT1:COLOR 15,1
5270 IF IOPT1 = 1 THEN 5280 ELSE IOPT1 = 0
5280 PRINT
5290 IOPT2 = 0
5300 PRINT "Would you like an output of particle locations to a datafile to be
 used in            plotting  ( 0-NO / 1-YES ) : [1]  ? ";:COLOR 10,1:LINE INPU
T IOPT3$:COLOR 15,1
5310 IF IOPT3$= "" THEN IOPT3=1 ELSE IF IOPT3$="1" THEN IOPT3=1 ELSE IOPT3 = 0
5320 PRINT
5330 PRINT "Would you like a printer/screen number plot of oil slickparticle d
```

```
istribution    (Refer to reference manual) ( 0-NO / 1-YES) : [0] ";:COLOR 10,
1:INPUT IOPT4:COLOR 15,1
5340 IF IOPT4 = 1 THEN 5350 ELSE IOPT4 = 0
5350 PRINT
5360 PRINT "What is the duration of oil spill (hrs.) : [1.0] ?";:COLOR 10,1:LI
NE INPUT B$:COLOR 15,1
5370 IF B$="" THEN SPLTIM =3600 ELSE SPLTIM = VAL(B$)*3600:IF SPLTIM = 0! THEN
  SPLTIM=1!
5380 IF B$ = "" THEN B$ = "1.0"
5390 PRINT:PRINT"Do you wish to use the default formulation for the horizontal
 diffusion          for River?"
5400 PRINT"Hit the return key for the default formulation or enter the desired
 value for   horizontal diffusion coefficient. (sq. ft/sec)   ";
5410 COLOR 10,1 :LINE INPUT">";A$:COLOR 15,1
5420 IF A$="" THEN HDC=-1! ELSE HDC=VAL(A$)
5421 IF FILE$="R" OR FILE$="r" THEN GOTO 5430
5422 PRINT:PRINT"Do you wish to use the default formulation for the horizontal
 diffusion          for Lake?"
5423 PRINT"Hit the return key for the default formulation or enter the desired
 value for   horizontal diffusion coefficient. (sq. ft/sec)   ";
5425 COLOR 10,1 :LINE INPUT">";APY$:COLOR 15,1
5427 IF APY$="" THEN HDCL=-1! ELSE HDCL=VAL(APY$)
5430 CLS
5440 PRINT"Total time of oil spill simulation (hrs.) : ";:COLOR 10,1:PRINT TOT
IME:COLOR 15,1
5450 PRINT
5460 PRINT"Frequency of obtaining output from PLOTNU and other subroutines
            (Number of steps between outputs)  : ";:COLOR 10,1:PRINT IEVERY:C
OLOR 15,1
5470 PRINT
5480 PRINT"Output of fixed data cross section geometry and shore conditions
            ( 0-NO / 1-YES )  : ";:COLOR 10,1:PRINT IOPT1:COLOR 15,1
5490 PRINT
5500 PRINT"Output of particle locations to a datafile to be used in plotting
            ( 0-NO / 1-YES )  : ";:COLOR 10,1:PRINT IOPT3:COLOR 15,1
5510 PRINT
5520 PRINT"Printer/screen number plot of particle distribution
            ( 0-NO / 1-YES )  : ";:COLOR 10,1:PRINT IOPT4:COLOR 15,1
5530 PRINT
5540 PRINT"Duration of oilspill (hrs.) : ";:COLOR 10,1:PRINT B$:COLOR 15,1
5550 PRINT:IF A$="" THEN PRINT"RIVER - Default formulation for the horizontal
diffusion coefficient has been   selected." ELSE PRINT"RIVER - Horizontal diff
usion coefficient = ";:COLOR 10,1:PRINT HDC;" sq.ft/sec":COLOR 15,1
5552 IF FILE$="r" OR FILE$="R" THEN GOTO 5560
5553 PRINT:IF APY$="" THEN PRINT"LAKE  - Default formulation for the horizonta
l diffusion coefficient has been   selected." ELSE PRINT"LAKE  - Horizontal di
ffusion coefficient =  ;:COLOR 10,1:PRINT HDCL;" sq.ft/sec":COLOR 15,1
5560 PRINT:PRINT"Is the above information correct?  ( Y / N ) : "
5570 A$=INKEY$
5580 IF A$="" THEN 5570 ELSE IF A$="n" THEN 5200 ELSE IF A$="N" THEN 5200 ELSE
 IF A$="y" THEN 5590 ELSE IF A$="Y" THEN 5590 ELSE BEEP : GOTO 5570
5590 IF FILE$="R" OR FILE$="r" THEN PRINT #1,USING"#####.##  ##   #   #   #
#   ####.##   #.####^^";TOTIME;IEVERY;IOPT1;IOPT2;IOPT3;IOPT4;SPLTIM;HDC
5595 IF FILE$="L" OR FILE$="l" THEN PRINT #1,USING"#####.##  ##   #   #   #
#   ####.##   #.####^^   #.###^^";TOTIME;IEVERY;IOPT1;IOPT2;IOPT3;IOPT4;SP
```

```
LTIM;HDC;HDCL
5600 CLS
5610 NTOTAL=500:SPGOIL=.9:ANIU=1.411E-05:SPILDT=15
5620 PRINT"What is the total number of particles defined in the system? [500]
            (Maximum allowed is 1000)     ";:COLOR 10,1:LINE INPUT">";A$:COLO
R 15,1
5630 IF A$ = "" THEN 5650 ELSE NTOTAL = VAL(A$)
5640 IF NTOTAL>1000 THEN PRINT"1000 has been entered.":IF NTOTAL > 1000 THEN N
TOTAL=1000
5650 PRINT
5660 PRINT "What is the total volume of the oil spill (U.S. gal.) ";:COLOR 10,
1:INPUT SPVOL:COLOR 15,1
5670 PRINT
5680 PRINT "What is the length of time step for simulation : [15] min > ";:COL
OR 10,1:LINE INPUT A$:COLOR 15,1
5690 IF A$="" THEN SPILDT = 15  ELSE SPILDT = VAL(A$)
5691 IF INT(60/SPILDT) <> (60/SPILDT) THEN 5692 ELSE 5700
5692 COLOR 12,1:BEEP:PRINT"WARNING: One hour divided by time step must be a ro
und number."
5693 PRINT"eg. 13 minutes is not allowed.":COLOR 15,1
5694 PRINT"Re enter the length of time step for simulation : [15] min > ";:COL
OR 10,1:LINE INPUT A$:COLOR 15,1
5695 GOTO 5690
5700 PRINT
5710 PRINT"What is the specific gravity of oil? ";:COLOR 10,1
5720 IF OILNAME$="Gasoline" THEN 5750
5730 IF OILNAME$="Bunker C" THEN 5760
5740 IF OILNAME$="Fuel Oil No.2" THEN 5770 ELSE 5780
5750 PRINT"Gasoline  [0.7]";:SPGOIL=.7 : GOTO 5790
5760 PRINT"Bunker C  [0.98]";: SPGOIL = .98 :GOTO 5790
5770 PRINT"Fuel Oil No.2    [0.84]";: SPGOIL = .84 : GOTO 5790
5780 PRINT USING"\                    \  _[#.##_] : ";OILNAME$;SPGOIL;
5790 LINE INPUT" >";A$:COLOR 15,1
5800 PRINT
5810 IF A$ = "" THEN 5820 ELSE SPGOIL = VAL(A$)
5820 PRINT"What is the kinematic viscosity of water? ";:COLOR 10,1
5830 PRINT USING"_[####.###^^^^_]";ANIU;
5840 LINE INPUT" sq ft/sec  >";A$:COLOR 15,1
5850 IF A$ = "" THEN 5860 ELSE ANIU = VAL(A$)
5860 PRINT
5870 PRINT"What is the surface tension of oil? ";:COLOR 10,1
5880 IF OILNAME$="Gasoline" THEN 5910
5890 IF OILNAME$="Bunker C" THEN 5920
5900 IF OILNAME$="Fuel Oil No.2" THEN 5930 ELSE 5940
5910 PRINT"Gasoline  [0.7550E-03]";:SIGMA = .000755 : GOTO 5950
5920 PRINT"Bunker C  [0.7550E-03]";: SIGMA  = .000755 :GOTO 5950
5930 PRINT"Fuel Oil No.2    [0.7550E-03]";: SIGMA  = .000755 : GOTO 5950
5940 PRINT USING"\                    \ _[#.##_] : ";OILNAME$;SIGMA;
5950 LINE INPUT" lbs/ft  >";A$:COLOR 15,1
5960 PRINT
5970 IF A$ = "" THEN 5980 ELSE SIGMA = VAL(A$)
5980 CLS
5990 PRINT"Total number of particles defined in the system : ";:COLOR 10,1:PRI
NT NTOTAL:COLOR 15,1
6000 PRINT
```

```
6010 PRINT"Total volume of oilspill (U.S. gal.) : ";:COLOR 10,1:PRINT SPVOL:CO
LOR 15,1
6020 PRINT
6030 PRINT"Length of time step for spill simulation : ";:COLOR 10,1:PRINT SPIL
DT;" min":COLOR 15,1:SPILDT=SPILDT*60
6040 PRINT
6050 PRINT"Specific gravity of oil : ";:COLOR 10,1:PRINT SPGOIL:COLOR 15,1
6060 PRINT:PRINT"Kinematic viscosity of water : ";:COLOR 10,1:PRINT ANIU;" (sq
 ft/sec)":COLOR 15,1
6070 PRINT:PRINT"Surface tenstion of oil : ";:COLOR 10,1:PRINT SIGMA;" (lbs/ft
)":COLOR 15,1
6080 PRINT
6090 PRINT"Is the above information correct? ( Y / N ) "
6100 A$ = INKEY$
6110 IF A$ = "" THEN 6100 ELSE IF A$="y" THEN 6120 ELSE IF A$="Y" THEN 6120 EL
SE IF A$="n" THEN 5600 ELSE IF A$="N" THEN 5600 ELSE BEEP : GOTO 6100
6120 PRINT #1,USING"#### ######.# ****.# #.## ##.###^^ ##.###^^ 1.14 0.98
1.6 1.4 1.4 1.4 ";NTOTAL;SPVOL;SPILDT;SPGOIL;ANIU;SIGMA
6130 CLS
6140 VMOL=.007063:SOLBLT=.001873:CEVP=7.88:TE=468!:API=10!
6150 PRINT"What is the X-coordinate of spill site (ft) ";:COLOR 10,1:INPUT SPX
:COLOR 15,1
6160 PRINT
6170 PRINT"What is the Y-coordinate of spill site (ft) ";:COLOR 10,1:INPUT SPY
:COLOR 15,1
6180 PRINT
6190 PRINT"What is the molar volume of oil? ";:COLOR 10,1:LINE INPUT"[.7063E-0
2] (cu ft/mol)  >";A$:COLOR 15,1
6200 IF A$="" THEN 6210 ELSE VMOL=VAL(A$)
6210 PRINT
6220 PRINT"What is the solubility of fresh oil? ";:COLOR 10,1
6230 IF OILNAME$="Gasoline" THEN 6260
6240 IF OILNAME$="Bunker C" THEN 6270
6250 IF OILNAME$="Fuel Oil No.2" THEN 6280 ELSE 6290
6260 PRINT"Gasoline  [0.1873E-02] lbs/cu ft";: SOLBLT =.001873:GOTO 6300
6270 PRINT"Bunker C  [0.0] lbs/cu ft";: SOLBLT = 0! :GOTO 6300
6280 PRINT"Fuel Oil No.2   [0.1873E-02] lbs/cu ft";: SOLBLT = .001873 : GOTO 6
300
6290 PRINT USING"\                    \  [0.1873E-02] lbs/cu ft";OILNAME$;:SOLBLT
 = .001873
6300 LINE INPUT" >";A$:COLOR 15,1
6310 PRINT
6320 IF A$="" THEN 6330 ELSE SOLBLT=VAL(A$)
6330 PRINT"What is the boiling point temperature of oil?   Note: Characteristi
c curves for crude oils will be used if you enter a value less than 1.0 for th
e boiling      point temperature.  If you choose this option the value for Coe
fficient C will"
6340 PRINT"be automaticaly be computed.  ";:COLOR 10,1
6350 IF OILNAME$="Gasoline" THEN 6380
6360 IF OILNAME$="Bunker C" THEN 6390
6370 IF OILNAME$="Fuel Oil No.2" THEN 6400 ELSE 6410
6380 PRINT"Gasoline  [311.0]";: TE=311! : GOTO 6420
6390 PRINT"Bunker C  [783.0]";: TE = 783: :GOTO 6420
6400 PRINT"Fuel Oil No.2   [468.0]";: TE = 468! : GOTO 6420
6410 PRINT USING"\                    \  [468.0]";OILNAME$;
```

```
6420 LINE INPUT" deg.K  >";A$:COLOR 15,1
6430 IF A$="" THEN 6440 ELSE TE=VAL(A$)
6440 IF TE < 1! THEN 6570
6450 PRINT
6460 PRINT"What is the coefficient C of evaporation characteristics of oil? ":
COLOR 10,1
6470 IF OILNAME$="Gasoline" THEN 6500
6480 IF OILNAME$="Bunker C" THEN 6510
6490 IF OILNAME$="Fuel Oil No.2" THEN 6520 ELSE 6530
6500 PRINT"Gasoline  [6.11]";: CEVP =6.11:GOTO 6540
6510 PRINT"Bunker C  [3.37]";: CEVP  = 3.37 :GOTO 6540
6520 PRINT"Fuel Oil No.2  [7.68]";: CEVP  = 7.68 : GOTO 6540
6530 PRINT USING"\                    \  [7.88]";OILNAME$;
6540 LINE INPUT" >";A$:COLOR 15,1
6550 IF A$="" THEN 6560 ELSE CEVP=VAL(A$)
6560 PRINT
6570 CLS
6580 PRINT"X-coordinate of spill site is : ";:COLOR 10,1:PRINT SPX;"ft":COLOR
15,1
6590 PRINT
6600 PRINT"Y-coordinate of spill site is : ";:COLOR 10,1:PRINT SPY;"ft":COLOR
15,1
6610 PRINT
6620 PRINT"Molar volume of oil is : ";:COLOR 10,1:PRINT VMOL;" cu ft/mol":COLO
R 15,1
6630 PRINT
6640 PRINT"Solubility of fresh oil is : ";:COLOR 10,1:PRINT SOLBLT;" lbs/cu ft
":COLOR 15,1
6650 PRINT
6660 PRINT"Coefficient C of evaporation characteristics of oil is : ";:COLOR 1
0,1:PRINT CEVP:COLOR 15,1
6670 PRINT
6680 PRINT"Boiling point temperature of oil is : ";:COLOR 10,1:PRINT TE;"deg K
":COLOR 15,1
6690 PRINT
6700 PRINT"Is the above information correct?  ( Y / N ) :"
6710 A$=INKEY$
6720 IF A$="" THEN 6710 ELSE IF A$="Y" THEN 6730 ELSE IF A$="y" THEN 6730 ELSE
 IF A$="N" THEN 6130 ELSE IF A$="n" THEN 6130 ELSE BEEP: GOTO 6710
6730 PRINT #1,USING"#######.#  #######.#  #.#####^^  #.#####^^  #.##  ###.
#";SPX;SPY;VMOL;SOLBLT;CEVP;TE
6740 VMAG=0:THETA=0:TENVF=0:COUNT=1
6750 CLS
6760 PRINT"We are now entering data needed for the hour # ";:COLOR 10,1:PRINT
COUNT;:COLOR 15,1:PRINT" wind and air temperature."
6770 PRINT
6780  PRINT USING "What is the wind speed ( mph ) ?  [###.#] ";MAG;:COLOR 10,1
:LINE INPUT" >";A$:COLOR 15,1
6790 IF A$="" THEN 6810 ELSE MAG=VAL(A$)
6800 VMAG=MAG*1.466667
6810 PRINT
6820 PRINT USING "What is the wind direction  (Clockwise angle measured from N
orth in degrees? :    [###.#] ";THETA;:COLOR 10,1:LINE INPUT" >";A$:COLOR 15,1
6830 IF A$="" THEN 6840 ELSE THETA=VAL(A$)
6840 PRINT
```

```
    PRINT USING "What is the air temperature in deg. F.?  [###.#] ";TENVF;::CO
LOR 10,1:LINE INPUT">";A$:COLOR 15,1
IF A$="" THEN 6870 ELSE TENVF=VAL(A$)
CLS
PRINT"Data for hour # ";:COLOR 10,1:PRINT COUNT;:COLOR 15,1:PRINT" of sim
ulation"
PRINT
PRINT"Wind speed is :";:COLOR 10,1:PRINT USING"###.# mph     (####.# ft/s)
";VMAG;VMAG:COLOR 15,1
PRINT
PRINT"Wind direction is : ";:COLOR 10,1:PRINT THETA:COLOR 15,1
PRINT
PRINT"Air temperature is : ";:COLOR 10,1:PRINT TENVF;:COLOR 15,1:PRINT" d
eg F"
PRINT
PRINT"Is the above information correct? ( Y / N ) : "
A$=INKEY$
IF A$="" THEN 6970 ELSE IF A$="Y" THEN 6985 ELSE IF A$="y" THEN 6985 ELSE
 IF A$="N" THEN 6750 ELSE IF A$="n" THEN 6750 ELSE BEEP: GOTO 6970
FOR X = 1 TO (3600/SPILDT)
PRINT #1, USING "###.#   ###.#   ###.#";VMAG;THETA;TENVF
NEXT X
PRINT
COUNT = COUNT + 1
IF COUNT > TOTIME THEN 7060
PRINT"Would you like to  R'epeat the above values for hour # ";:COLOR 10,
1:PRINT USING"##";COUNT;:COLOR 15,1:PRINT" or enter  N'ew values? ( R / N ) :
"
A$ INKEY$
IF A$="" THEN 7040 ELSE IF A$="R" THEN 6985 ELSE IF A$="r" THEN 6985 ELSE
 IF A$="N" THEN 6750 ELSE IF A$="n" THEN 6750 ELSE BEEP: GOTO 7040
CLOSE #1:RETURN
REM ***************************************************************
REM     this section creates the FLW file
REM ***************************************************************
COUNT 0
B$ FILENAME$+".flw":OPEN "O",#1,B$
DIM TIC(25),VL(25),Q(25)
PRINT"What is the time step for river flow computation (hrs)":COLOR 1
PRINT" NOTE: This cannot exceed total simulation period. ";:COLOR 10,1:INP
UT UFDT:COLOR 15,1
PRINT
PRINT"Is the time step for river flow computation ";:COLOR 10,1:PRINT USI
NG"##.#";UFDT;:COLOR 15,1:PRINT"hrs.? ( Y / N )"
A$ INKEY$
IF A$="" THEN 7160 ELSE IF A$="Y" THEN 7180 ELSE IF A$="y" THEN 7180 ELSE
 IF A$="N" THEN 7130 ELSE IF A$="n" THEN 7130 ELSE BEEP:GOTO 7160
PRINT #1,USING"##.#";UFDT
NNODE 0
TEST$ LEFT$(FILENAME$,4):IF FILE$="L" OR FILE$="l" THEN TEST$=LEFT$(FILEN
AME$,4)
IF TEST$ "STCL" OR TEST$="stcl" THEN NNODE = 9
IF TEST$ "DETR" OR TEST$="detr" THEN NNODE = 22
IF TEST$ "STMU" OR TEST$="stmu" THEN NNODE = 6
IF TEST$ "STML" OR TEST$="stml" THEN NNODE = 13
```

```
7194 IF TEST$="LDETR" OR TEST$="ldetr" THEN NNODE = 22
7196 IF NNODE >< 0 GOTO 7204
7198 PRINT: PRINT.PRINT " Your filename specification does not match with anyr
ecommended name patterns     Enter the no. of branches in the unsteady flow mod
el for the river"
7200 INPUT NNODE
7204 CLS
7208 FOR I = 1 TO NNODE
7220 PRINT"Node No.";:COLOR 10,1:PRINT USING" ###";I:PRINT:COLOR 15,1
7230 PRINT "What is the water level? ";:COLOR 10,1:PRINT USING" [####.##] ft";
WL(I-1);:COLOR 15,1:LINE INPUT "  >";A$
7240 IF A$="" THEN WL(I)=WL(I-1) ELSE WL(I)=VAL(A$)
7250 PRINT
7260 PRINT"What is the dicharge? ";:COLOR 10,1:PRINT USING" [######.#] cfs";Q(
I 1);:COLOR 15,1:LINE INPUT "  >";A$
7270 IF A$="" THEN Q(I)=Q(I-1) ELSE Q(I)=VAL(A$)
7280 CLS
7290 PRINT"Node No.";:COLOR 10,1:PRINT USING" ###";I:COLOR 15,1:PRINT
7300 PRINT"Water level is";:COLOR 10,1:PRINT USING"  ####.## ft";WL(I):COLOR 1
5,1:PRINT
7310 PRINT"Discharge is";:COLOR 10,1:PRINT USING"  ######.# cfs";Q(I):COLOR 15
,1:PRINT
7320 PRINT "Is this information correct? ( Y / N ) :"
7330 A$=INKEY$
7340 IF A$="" THEN 7330 ELSE IF A$="Y" THEN 7350 ELSE IF A$="y" THEN 7350 ELSE
 IF A$="N" THEN 7210 ELSE IF A$="n" THEN 7210 ELSE BEEP:GOTO 7330
7350 PRINT #1,USING"####.##   ######.#";WL(I);Q(I):PRINT
7380 NEXT I
7390 PRINT
7400 PRINT"What is the number of cross sections with ice covered conditions ";
:COLOR 10,1:INPUT ICINFO:COLOR 15,1
7410 PRINT:PRINT"Is number of cross sections with ice covered conditions :";:C
OLOR 10,1:PRINT USING" ### ? ( Y / N )";ICINFO:COLOR 15,1
7420 A$=INKEY$
7430 IF A$="" THEN 7420 ELSE IF A$="Y" THEN 7440 ELSE IF A$="y" THEN 7440 ELSE
 IF A$="N" THEN 7390 ELSE IF A$="n" THEN 7390 ELSE BEEP:GOTO 7420
7440 PRINT:IF ICINFO=0 THEN 7450 ELSE 7460
7450 PRINT #1,"    1":PRINT#1,"    2 OPEN":PRINT:GOTO 7780
7460 PRINT #1,USING "####";ICINFO
7470 FOR J=1 TO ICINFO
7480 COLOR 15,1:PRINT"What is the cross section no.";:COLOR 10,1:INPUT IS:COLO
R 15,1
7490 PRINT"The cross section ice cover condition is : ( 1-FULL / 2-PART / 3-OP
EN )"
7500 A$=INKEY$:IF A$="" THEN 7500 ELSE IF A$="1" THEN WORD$="FULL" ELSE IF A$=
"2" THEN WORD$="PART" ELSE WORD$="OPEN"
7505 W = VAL(A$)
7506 IF W<1 OR W > 3 THEN PRINT" That is not a valid number ... Re-Enter ..."
       : GOTO 7490
7510 PRINT:PRINT "Cross section no. ";:COLOR 10,1:PRINT IS;:COLOR 15,1:PRINT"
has a(n) ";:COLOR 10,1:PRINT WORD$;:COLOR 15,1:PRINT" ice condition.":PRINT"Is
 this correct? ( Y / N ) : "
7520 A$=INKEY$
7530 IF A$="" THEN 7520 ELSE IF A$="Y" THEN 7540 ELSE IF A$="y" THEN 7540 ELSE
 IF A$="N" THEN 7480 ELSE IF A$="n" THEN 7480 ELSE BEEP:GOTO 7520
```

```
7540 COLOR 10,1:IF W=1 THEN PRINT #1,USING"#### FULL";IS ELSE IF W=2 THEN PRIN
T #1,USING"#### PART";IS ELSE PRINT #1,USING"#### OPEN";IS:PRINT
7550 IF WORD$="FULL" THEN 7560 ELSE 7600
7560 COLOR 15,1:PRINT"What is the thickness of the ice? (ft): ";:COLOR 10,1:IN
PUT FULLTI:COLOR 15,1:PRINT"Is the ice thickness ";:COLOR 10,1 :PRINT USING"##
.##ft ? ( Y / N ) : ";FULLTI:COLOR 15,1:PRINT
7570 A$=INKEY$
7580 IF A$="" THEN 7570 ELSE IF A$="Y" THEN 7590 ELSE IF A$="y" THEN 7590 ELSE
 IF A$="N" THEN 7560 ELSE IF A$="n" THEN 7560 ELSE BEEP:GOTO 7570
7590 PRINT #1,USING"###.##";FULLTI:GOTO 7770
7600 IF WORD$="PART" THEN 7610 ELSE 7770
7610 COLOR 15,1
7620 PRINT"How many sounding depths (vertical lines) define this cross section
?              (See supplied table) : ";:COLOR 10,1:INPUT NODEPTH:COLOR 15,1
7630 PRINT"Are there ";:COLOR 10,1:PRINT USING"###";NODEPTH; :COLOR 15,1:PRINT
" sounding depths in this cross section? ( Y / N ) : "
7640 A$=INKEY$
7650 IF A$="" THEN 7640 ELSE IF A$="Y" THEN 7660 ELSE IF A$="y" THEN 7660 ELSE
 IF A$="N" THEN 7610 ELSE IF A$="n" THEN 7610 ELSE BEEP:GOTO 7640
7660 FOR NO=1 TO NODEPTH
7670 PRINT:PRINT"What is the ice thickness (ft) at vertical line #";:COLOR 10,
1:PRINT USING"## ";NO;:INPUT TICE(NO):COLOR 15,1
7680 PRINT"Is the ice thickness at vertical line ";:COLOR 10,1:PRINT USING"##
: ###.##ft ( Y / N ) ";NO;TICE(NO):COLOR 15,1
7690 A$=INKEY$
7700 IF A$="" THEN 7690 ELSE IF A$="Y" THEN 7710 ELSE IF A$="y" THEN 7710 ELSE
 IF A$="N" THEN 7670 ELSE IF A$="n" THEN 7670 ELSE BEEP:GOTO 7690
7710 NEXT NO
7720 FOR NO=1 TO NODEPTH
7730 PRINT #1,USING"##.##   ";TICE(NO);
7740 NEXT NO
7750 PRINT #1," "
7760 PRINT
7770 NEXT J
7780 COLOR 15,1:PRINT:L=L+1:LL=L+1:PRINT"Do you need time step ";:COLOR 10,1:P
RINT USING"##";LL;:COLOR 15,1:PRINT" for river flow computation? ( Y / N ) :"
7790 A$=INKEY$
7800 IF A$="" THEN 7790 ELSE IF A$="Y" THEN 7190 ELSE IF A$="y" THEN 7190 ELSE
 IF A$="N" THEN 7810 ELSE IF A$="n" THEN 7810 ELSE BEEP:GOTO 7790
7810 CLOSE #1:RETURN
7820 REM ******************************************************
7830 REM          This section of the program creates ICE files
7840 REM ******************************************************
7850 COUNT=0
7860 B$=FILENAME$+".ice":OPEN "O",#1,B$
7870 CLS:PRINT"Are you running for an open water case? ( Y / N )"
7880 A$=INKEY$:IF A$="" THEN 7880 ELSE IF A$="Y" THEN 7890 ELSE IF A$="y" THEN
 7890 ELSE IF A$="N" THEN 7920 ELSE IF A$="n" THEN 7920 ELSE BEEP : GOTO 7880
7890 PRINT #1 ,"0.035  0.84"
7900 FOR DD=1 TO 4 : PRINT #1,"0" : NEXT DD
7910 CLOSE #1 : RETURN
7920 DIM NICEX1(20),NICEY1(20),NICEX2(20),NICEY2(20)
7930 CLS:AMICE=.035:AMUO=.84
7940 PRINT"What is Manning's n for ice roughness? ";:COLOR 10,1:LINE INPUT " [
DEFAULT = .035]";A$:COLOR 15,1
```

```
7950 IF A$="" THEN 7960 ELSE ANICE=VAL(A$)
7960 PRINT
7970 PRINT"What is the viscosity of oil? ";:COLOR 10,1:LINE INPUT" [0.84] lbs/
ft sec  >";A$:COLOR 15,1
7980 IF A$="" THEN 7990 ELSE AMIUO=VAL(A$)
7990 CLS
8000 PRINT"Manning's n for ice roughness : ";:COLOR 10,1:PRINT ANICE :COLOR 15
,1
8010 PRINT
8020 PRINT"Viscosity of oil : ";:COLOR 10,1:PRINT AMIUO;" (lbs/ft sec)" :COLOR
 15,1
8030 PRINT
8040 PRINT"Is the above information correct? ( Y / N ) : "
8050 A$=INKEY$
8060 IF A$="" THEN 8050 ELSE IF A$="Y" THEN 8070 ELSE IF A$="y" THEN 8070 ELSE
 IF A$="N" THEN 7930 ELSE IF A$="n" THEN 7930 ELSE BEEP:GOTO 8050
8070 PRINT #1, USING"#.###  ##.###";ANICE;AMIUO
8080 CLS
8090 COUNT=COUNT +1
8100 CLS
8110 PRINT"For the unsteady flow model time step : ";:COLOR 10,1:PRINT COUNT:C
OLOR 15,1
8120 PRINT
8130 PRINT"What is the total number of ice regions ";:COLOR 10,1:INPUT NICERG:
COLOR 15,1
8140 IF FILE$="R" THEN 8160 ELSE IF FILE$="r" THEN 8160
8150 PRINT:PRINT"What is the number of ice regions in lake ";:COLOR 10,1:INPUT
 LICERG:COLOR 15,1
8160 PRINT:PRINT
8170 PRINT"The total number of ice regions is : ";:COLOR 10,1:PRINT NICERG :CO
LOR 15,1
8180 IF FILE$="R" THEN 8200 ELSE IF FILE$="r" THEN 8200
8190 PRINT:PRINT"The total number of ice regions in lake is : ";:COLOR 10,1:PR
INT LICERG:COLOR 15,1
8200 PRINT
8210 PRINT"Is this correct? ( Y / N ) : "
8220 A$=INKEY$
8230 IF A$="" THEN 8220 ELSE IF A$="Y" THEN 8240 ELSE IF A$="y" THEN 8240 ELSE
 IF A$="N" THEN 8100 ELSE IF A$="n" THEN 8100 ELSE BEEP:GOTO 8220
8240 IF FILE$="R" THEN 8260 ELSE IF FILE$="r" THEN 8260
8250 PRINT #1,USING"###  ###";NICERG;LICERG:J=0:GOTO 8270
8260 PRINT #1,USING"###";NICERG
8270 FOR I=1 TO NICERG
8280 CLS:IF FILE$="R" THEN 8290 ELSE IF FILE$="r" THEN 8290 ELSE PRINT"Note: L
ake ice regions must be input first.":PRINT
8290 PRINT "Ice region no. ";:COLOR 10,1:PRINT USING "###";I:COLOR 15,1
8300 PRINT
8310 PRINT"The x grid at the oeginning of ice region ";:COLOR 10,1:INPUT NICEX
1(I):COLOR 15,1
8320 PRINT"The y grid at the beginning of ice region ";:COLOR 10,1:INPUT NICEY
1(I):COLOR 15,1
8330 PRINT"The x grid at the end of ice region ";:COLOR 10,1:INPUT NICEX2(I):C
OLOR 15,1
8340 PRINT"The y grid at the end of ice region ";:COLOR 10,1:INPUT NICEY2(I):C
OLOR 15,1
```

```
8350 IF FILE$="R" THEN 8380 ELSE IF FILE$="r" THEN 8380 ELSE J=J+1
8360 IF J>LICERG THEN 8380
8370 PRINT:PRINT"What is the ice thickness in lake ice region (ft)";:COLOR 10,
1:INPUT;ZLKICE:COLOR 15,1
8380 CLS
8390 PRINT"Ice region no. ";:COLOR 10,1:PRINT USING"###";I:COLOR 15,1
8400 PRINT
8410 PRINT"The x,y grid ";:COLOR 10,1:PRINT USING"### ,###";NICEX1(I);NICEY1(I
);:COLOR 15,1:PRINT" to the x,y grid ";:COLOR 10,1:PRINT USING"### ,###";NICEX
2(I);NICEY2(I):COLOR 15,1
8420 PRINT:IF FILE$="R" THEN 8460 ELSE IF FILE$="r" THEN 8460
8430 IF FILE$="R" THEN 8460 ELSE IF FILE$="r" THEN 8460
8440 IF J > LICERG THEN 8460
8450 PRINT"The ice thickness in lake ice region is : ";:COLOR 10,1:PRINT USING
"##.##";ZLKICE:COLOR 15,1
8460 PRINT:PRINT"Is the above information correct? ( Y / N ) "
8470 A$=INKEY$
8480 IF A$="" THEN 8470 ELSE IF A$="Y" THEN 8500 ELSE IF A$="y" THEN 8500 ELSE
 IF A$="N" THEN 8490 ELSE IF A$="n" THEN 8490 ELSE BEEP:GOTO 8470
8490 J=J-1:GOTO 8280
8500 PRINT #1, USING"### ### ### ###";NICEX1(I);NICEY1(I);NICEX2(I);NICEY2(I)
8510 IF FILE$="R" THEN 8520 ELSE IF FILE$="r" THEN 8520 ELSE IF J > LICERG THE
N  8520 ELSE PRINT#1,USING"##.##";ZLKICE
8520 NEXT I
8530 J=0:PRINT:PRINT"Would you like to enter data for another time interval? (
 Y / N ) : "
8540 A$=INKEY$
8550 IF A$="" THEN 8540 ELSE IF A$="Y" THEN 8090 ELSE IF A$="y" THEN 8090 ELSE
 IF A$="N" THEN 8560 ELSE IF A$="n" THEN 8560 ELSE BEEP: GOTO 8540
8560 CLOSE #1:RETURN
8570 REM ************************************************************
8580 REM    this section of the program creates the  BND files
8590 REM ************************************************************
8600 COUNT=0 : K=1
8610 B$=FILENAME$+".bnd":OPEN "O",#1,B$
8620 COUNT=COUNT+1
8630 CLS:COLOR 15,1
8640 PRINT"Half life designation for shores:  range no. ";:COLOR 10,1:PRINT US
ING" ###";COUNT:COLOR 15,1
8650 PRINT
8660 PRINT "Shore number"
8670 PRINT "1 = lower river"
8680 PRINT "2 = upper river"
8690 PRINT "3 = lower island"
8700 PRINT "4 = upper island"
8710 PRINT"Enter shore number code ( 1 / 2 / 3 / 4 ) : [ ";:COLOR 10,1:PRINT U
SING"#";K;:COLOR 15,1:PRINT" ]";:COLOR 10,1:LINE INPUT" >";A$:COLOR 15,1
8720 IF A$="" THEN 8730 ELSE K=VAL(A$)
8730 PRINT
8740 PRINT"What is the beginning box no. for this range ";:COLOR 10,1:INPUT LF
ROM:COLOR 15,1
8750 PRINT
8760 PRINT"What is the ending box no. for this range ";:COLOR 10,1:INPUT LTO:C
OLOR 15,1
8770 PRINT
```

```
8780 PRINT"What is the half life code to be assigned to this range (1-10) ";:C
OLOR 10,1:INPUT ICODE:COLOR 15,1
8790 CLS
8800 PRINT"Half life designation for shores: range no. ";:COLOR 10,1:PRINT USI
NG"###";COUNT:COLOR 15,1
8810 PRINT
8820 PRINT"Shore number ";:COLOR 10,1
8830 IF K=1 THEN PRINT " 1  lower river"
8840 IF K=2 THEN PRINT " 2  upper river"
8850 IF K=3 THEN PRINT " 3  lower island"
8860 IF K=4 THEN PRINT " 4  upper island"
8870 PRINT:COLOR 15,1
8880 PRINT"Half life designation to shore limits in x direction (Grid Box numb
ers)"
8890 PRINT"Begins at ";:COLOR 10,1:PRINT USING"###";LFROM;:COLOR 15,1:PRINT" ,
 ends at ";:COLOR 10,1:PRINT USING"###";LTO:COLOR 15,1
8900 PRINT
8910 PRINT"The half life code assigned to this range: ";:COLOR 10,1:PRINT USIN
G"##";ICODE:COLOR 15,1
8920 PRINT
8930 PRINT"Is the above information correct? ( Y / N ) : "
8940 A$=INKEY$
8950 IF A$="" THEN 8940 ELSE IF A$="Y" THEN 8960 ELSE IF A$="y" THEN 8960 ELSE
 IF A$="N" THEN 8630 ELSE IF A$="n" THEN 8630 ELSE BEEP:GOTO 8940
8960 PRINT #1,USING "#  ###  ###  ##";K;LFROM;LTO;ICODE
8970 PRINT
8980 PRINT"Do you wish to create another range of grid boxes? ( Y / N ) :"
8990 A$=INKEY$
9000 IF A$="" THEN 8990 ELSE IF A$="Y" THEN 8620 ELSE IF A$="y" THEN 8620 ELSE
 IF A$="N" THEN 9010 ELSE IF A$="n" THEN 9010 ELSE BEEP:GOTO 8940
9010 C=0:PRINT #1,USING "#  ###  ###  ##";C;C;C;C
9020 CLOSE #1 : RETURN
9030 REM ************************************************************
9040 REM      This section of the program creates lakewind.dat
9050 REM ************************************************************
9060 OPEN"O",#1,"lakewind.dat"
9070 CLS
9080 COLOR 15,1
9090 PRINT"The time at which the wind observation is made is (hrs.) ";:COLOR 1
0,1:INPUT TLAST:COLOR 15,1 :PRINT
9100 PRINT"The latitude of wind observation point is (deg. north) ";:COLOR 10,
1:INPUT RLAT:COLOR 15,1:PRINT
9110 PRINT"The longitude of wind observation point (deg. west) ";.COLOR 10,1:I
NPUT RLON:COLOR 15,1:PRINT
9120 PRINT"The height of instruments is (ft) ";:COLOR 10,1:INPUT Z:COLOR 15,1:
PRINT
9130 PRINT"The temperature of air is (deg F) ";:COLOR 10,1:INPUT TA:COLOR 15,1
:PRINT
9140 PRINT"The temperature of water is (deg. F) ";:COLOR 10,1:INPUT TW:COLOR 1
5,1:PRINT
9150 PRINT"The wind speed is (mph) ";:COLOR 10,1:INPUT WS:COLOR 15,1:PRINT:IF
WS=0 THEN 9160 ELSE WSS=WS*1.466667
9160 PRINT"The wind direction is (deg. Clockwise) ";:COLOR 10,1:INPUT WD:COLOR
 15,1
9170 CLS
```

```
9180 PRINT"The time of observation is: ";:COLOR 10,1:PRINT USING"####.## hrs";
TLAST:COLOR 15,1:PRINT
9190 PRINT"The latitude of wind observation point is: ";:COLOR 10,1:PRINT USIN
G"###.## deg North";RLAT:COLOR 15,1:PRINT
9200 PRINT"The longitude of wind obeservation point is: ";:COLOR 10,1:PRINT US
ING"###.## deg West";RLON:COLOR 15,1:PRINT
9210 PRINT"The height of instruments is: ";:COLOR 10,1:PRINT USING"###.## ft."
;Z:COLOR 15,1:PRINT
9220 PRINT"The temperature of air is: ";:COLOR 10,1:PRINT USING"###.## deg. F"
;TA:COLOR 15,1:PRINT
9230 PRINT"The temperature of water is: ";:COLOR 10,1:PRINT USING"###.## deg.
F";TW:COLOR 15,1:PRINT
9240 PRINT"The wind speed is: ";:COLOR 10,1:PRINT USING"###.##  ft/sec   or  #
##.##  mph";WSS;WS:COLOR 15,1:PRINT
9250 PRINT"The wind direction is: ";:COLOR 10,1:PRINT USING"###.## deg";WD:COL
OR 15,1:PRINT
9260 PRINT"Is the above information correct? ( Y / N ) : "
9270 A$=INKEY$
9280 IF A$="" THEN 9270 ELSE IF A$="Y" THEN 9290 ELSE IF A$="y" THEN 9290 ELSE
 IF A$="N" THEN 9070 ELSE IF A$="n" THEN 9070 ELSE BEEP:GOTO 9270
9290 PRINT #1,USING" ####.#### ####.#### ####.#### ####.#### ####.#### ####.##
## ####.#### ###.#";TLAST;RLAT;RLON;Z;TA;TW;WSS;WD
9300 PRINT:PRINT"Would you like to enter data for another wind station or anot
her time step?      ( Y / N ) "
9310 A$=INKEY$
9320 IF A$="" THEN 9310 ELSE IF A$="Y" THEN 9070 ELSE IF A$="y" THEN 9070 ELSE
 IF A$="N" THEN 9330 ELSE IF A$="n" THEN 9330 ELSE BEEP:GOTO 9310
9330 VALUE = -1!
9335 PRINT #1,USING" ####.####";VALUE
9340 CLOSE #1: RETURN
```

Program IPROGR BAS

```
100       CHOICE% = 5
          : DIM RIVER$(6), ABREV$(5), ANGLE(5)
            : FOR I% = 1 TO CHOICE% : READ RIVER$(I%), ABREV$(I%), ANGLE(I%) :
 NEXT
110       DATA  "St. Clair River", "STCL", 109.0,
                 "Detroit River", "DETR", 127.1,
                   "Lower St. Mary's River", "STML", 27.2
120       DATA  "Upper St. Mary's River", "STMU", 6.0,
                 "Lake St. Clair and Detroit River", "LDETR", 127.1
130       CHOICE% = CHOICE% + 1
          : RIVER$(CHOICE%) = "Exit -- Return to main menu"
150       CLS
          : T% = (20-CHOICE%)\2
160       FOR I% =1 TO CHOICE%
          : LOCATE T%+I%,20 : PRINT USING "##)  "; I%;
            : PRINT RIVER$(I%)
170       NEXT
180       LOCATE T%+CHOICE%+2,25
          : PRINT "Select option number and then hit return:";
190       INPUT A%
          : A% = ABS(A%)
            : IF A%<1 OR A%>CHOICE% THEN 150
195       IF A% = CHOICE% THEN 230
197       PRINT
          : PRINT "What oil spill file would you like to look at <"+ABREV$(A%)
            + "SP.OUT> "; : INPUT A$ : IF A$ = "" THEN A$ = ABREV$(A%)+"SP.OUT
"
200       OPEN "PASSFIL.TMP" FOR OUTPUT AS #1
          : PRINT #1, ABREV$(A%) : PRINT #1, A$ : PRINT #1, ANGLE(A%)
            : CLOSE #1
220       CHAIN "IPROGR.OVR"
225     '*************************************************************************
230 RUN"MOSS.BAS"
500       END
```

Program IPROGR OVR

```
1       ' ****************************************************************
          ' *                                                              *
            ' *                        IPROGR.OVR
*
2       ' *                                                              *
          ' ****************************************************************
            '
3         ON ERROR GOTO 10000
          : OPTION BASE 0
4         TX%=0:TY%=0:TX1%=0:TY1%=0:T%=0:TX=0:TY=0:TX1=0:TY1=0:T=0:T$=""
5         GOSUB 64000 : GOSUB 63000                    ' SET UP FOR HALO
6         DEF FNST$(A) = MID$(STR$(A),2)
7         DEF FNPADF$(T,LN%) = LEFT$(STR$(T),1)+STRING$(LN%-LEN(STR$(T)),48)
               + MID$(STR$(T),2)
8         DEF FNPADN$(T%,LN%) = STRING$(LN%-LEN(LEFT$(STR$(T%),LN%+1))+1,48)
               + MID$(LEFT$(STR$(T%),LN%+1),2)
9         DEF FNPAD$(A$,L%) = LEFT$(A$,L%) + SPACE$(L%-LEN(LEFT$(A$,L%)))
10        DEF FNUPPER$(A$)
               = CHR$(ASC(A$+CHR$(0))+(A$>="a" AND A$<="z")*(ASC("a")-ASC("A")
))
20        OPEN "PASSFIL.TMP" FOR INPUT AS #1 : INPUT #1, RIV$
          : INPUT #1, OIL.FIL$ : INPUT #1, NORTH : GOTO 23
21        INPUT "PLEASE ENTER RIVER CODE (IE: STCL OR DETR) ";RIV$
          : INPUT "PLEASE ENTER THE 'NORTH ANGLE' (IN DEGREES) ";NORTH
22        PRINT : PRINT "What oil spill file would you like to look at <"+RIV$
          + "SP.OUT> "; : INPUT OIL.FIL$
            : IF OIL.FIL$ = "" THEN OIL.FIL$ = RIV$+"SP.OUT"
23        CLOSE #1
          : X = FRE("")
39      ' ****************************************************************
          '       DEFINE STANDARD CONSTANTS
            '
40        CR$ = CHR$(13) : LF$ = CHR$(10) : CRLF$ = CR$  ' + LF$
41        ETX$  = CHR$(3) : INV$  = CHR$(11)
          ' END OF TEXT AND INVERSE LF CHAR FOR HP PLOTTER
42        BLANK$= SPACE$(80)
          : PU$ = "#### boxes with #####.# - #####.# gallons "
45        PI = 3.141593  : CNV = 1.4666
          : NORTH = (NORTH+90)*PI/180
            ' CONVERT DEGREES TO RADIANS AND FIX FOR SCREEN DISPLAY
47      ' ****************************************************************
          '       DEFINE THE IBM-PC SPECIFIC STUFF
            '
48        DWN$  = "2" : UP$   = "8" : LFT$  = "4" : RGHT$ = "6" : HOME$ = "7"
          : ARROW$ = DWN$+LFT$+RGHT$+UP$
60        BLACK%   = 0  : BLUE%    = 1  : GREEN%   = 2  : CYAN%    = 3
          : RED%     = 4  : MAGENTA% = 5  : BROWN%   = 6  : WHITE%   = 7
            : GREY%    = 8  : BBLUE%   = 9  : BGREEN%  = 10 : BCYAN%   = 11
61        BRED%    = 12 : BMAGENTA%= 13 : BYELLOW% = 14 : BWHITE%  = 15
          '       DEFINE THE COLORS IN HALO MODE 6 FOR THE TECMAR CARD
62        XPIXELS% = 640 : YPIXELS% = 400
          : XPIX% = 7  :  YPIX% = 7
            '         THE SIZE OF THE BLOCK IN COLOR DENSITY PLOT
64        XNUM% = (XPIXELS%-1)\XPIX% + 1
          : YNUM% = (YPIXELS%-1)\YPIX% + 1
```

```
          '       NOTE THAT OIL%() MUST BE DIMENSIONED TO AT LEAST XNUM% x Y
NUM%
65        OILCOL% = BLACK%                    ' THE COLOR OF OIL IN THE B&W PICTURE
66        LAND% = GREEN%
          : WATER% = BLUE%
            : TEXT% = MAGENTA%
68        BACK% = CYAN%
          : SHRLNE% = BLACK%
            '       DEFINE THE COLORS ON THE SCREEN
75        NCOL% = 7
          : DIM COL%(7), TMP%(7), BCOL%(8), GCOL(8)
77        COL%(0) = BMAGENTA%: COL%(1) = BBLUE% : COL%(2) = CYAN%
          : COL%(3) = BGREEN% : COL%(4) = BYELLOW% : COL%(5) = BROWN%
            : COL%(6) = RED% : COL%(7) = BLACK%
86      ' ********************************************************************
88        DIM PX(1000), PY(1000)
          ' THE X AND Y COORDINATE OF EACH PARTICLE OF OIL FOR THE CURRENT
            ' TIME STEP (SO WE CAN ZOOM IN IF NECESSARY)
90        DIM OIL%(92,58)
          '       MATRIX OF OIL CONCENTRATIONS
93        DIM STP%(20)
          '       ENOUGH ROOM TO STORE 20 TIME-STEPS (OF OIL MOVEMENTS)
            '       THESE ARE THE STEPS THAT THE USER WANTS TO SEE
94        DIM X%(1), Y%(1)
          '       TEMPORARY VARIABLES TO STORE X,Y LOCS OF CROSSHAIRS
95        PARAM.FIL$ = RIV$+".PAR" : OPEN PARAM.FIL$ FOR INPUT AS #4
          : INPUT #4, XMIN, YMIN, XMAX, YMAX
            : CLOSE #4
97        SHORE.FIL$ = RIV$+".BIN" : OPEN SHORE.FIL$ AS #3 LEN=10
          : FIELD #3, 4 AS XPT$, 4 AS YPT$, 2 AS PPT$
            : GET #3, 1 : CNT% = CVS(XPT$)
98        GEO.FIL$ = RIV$+".GBN" : OPEN GEO.FIL$ AS #1 LEN=17
          : FIELD #1, 1 AS TGP$, 4 AS XGP$, 4 AS YGP$, 8 AS PGP$
            : GET #1, 1 : CNTG% = CVS(XGP$)
99      ' ********************************************************************
            '                       THE GOOD STUFF
            '
100       STEP.NO% = 0 : NSTEP% = 0 : STEP.DONE% = 0
          : GOSUB 30310 : GOSUB 30080
            ' OPEN UP OILSPILL FILE AND GET USER OPTIONS
114       GOSUB 48000                         ' CHECK XMIN,XMAX,YMIN,YMAX
115       MINW = 32767 : MAXW = -32767
          : STIME = 0! : ETIME = 0!
190       IF STEP.NO% <> 0 THEN 303
          '       AM I JUST CHANGING SCALE?
279     ' ********************************************************************
          '       SKIP STEPS IF NECESSARY
            '
280       IF NSTEP%=0 THEN 295 ELSE STEP.NO% = STEP.NO% + 1
              : STEP.DONE% = STEP.DONE% + 1 : S$ = " "
                : IF NSTEP% = -1 THEN 285       ' SHOULD I DISPLAY ALL STEPS?
281       IF NSTEP%<STEP.DONE% THEN
              IF NSTEP%=0 THEN 340 ELSE GOSUB 30449 : GOTO 40000
282       IF STEP.NO% = STP%(STEP.DONE%) THEN 285
283       STEP.DONE% = STEP.DONE% -1 : S$ = "S" : GOSUB 30380
```

```
        : FOR I% = 1 TO NLINES%+1 : INPUT #2, DAT$ : NEXT : X = FRE("")
          : GOTO 280
285   ' ***************************************************************
        '       NOW DISPLAY A STEP
          '
286     IF STEP.NO%>1 THEN T% = LAND% : GOSUB 30395  ' ERASE WIND VECTOR
287     LINE INPUT #2,T$ : ELAPSE.T = VAL(MID$(T$,17,8))
        : WINDX = VAL(MID$(T$,25,7)) : WINDY = VAL(MID$(T$,31,6))
          : GAL.PRT = VAL(MID$(T$,38,7))
288     WIND = INT(.5+10*SQR(WINDX2+WINDY2))/10  ' MAGNITUDE OF WIND VECTO
R
294   ' ***************************************************************
        '       READ IN OIL POINTS
          '
295     IF NSTEP% = 0 THEN NL% = 0 ELSE NL% = NLINES%
300     CNPART%=0: FOR L%=1 TO NL% :LINE INPUT #2, D$ :FOR I%=1 TO 5
        : CNPART%=CNPART%+1 : PX(CNPART%)=VAL(MID$(D$,(I%-1)*15+1,8))
          : PY(CNPART%)=VAL(MID$(D$,(I%-1)*15+9,7))  :NEXT :NEXT :X=FRE("")
301     IF NOT MLT% THEN MINW = 32767 : MAXW = -32767
                         : STIME = 0! : ETIME = 0!
303     ETIME = ELAPSE.T
        : IF STIME=0! THEN STIME = ELAPSE.T
304     IF WIND<MINW THEN MINW = WIND
305     IF WIND>MAXW THEN MAXW = WIND
307     GOSUB 50300     'DRAW THE OIL SLICK
308     FIRST% =0
339   ' ***************************************************************
340     ER$ = "Pause - Use Arrow Keys to zoom"  : GOSUB 64500
        '       STANDARD "HIT ANY KEY TO CONTINUE" ROUTINE (GRAPHICS)
341     IF FNUPPER$(A$) = "Q" THEN GOSUB 30449 : GOTO 40000
        '       THE USER WANTS TO QUIT
342     IF A$ = HOME$ THEN
          GOSUB 30449 : FIRST%=-1 : GOTO 303
          '       REDRAW SCREEN AND OIL SLICK
343     IF FNUPPER$(A$)="C" THEN GOSUB 30449 :CALL CLOSEGRAPHICS
          :CLS :GOSUB 30051 : GOSUB 45028 : FIRST% =-1 : GOTO 114
          '       ENTER NEW COORDINATES FROM KEYBOARD
344     IF A$ = "S" THEN GOSUB 36000 : GOTO 340
        '       SAVE THE CURRENT COORDINATES AS THE DEFAULT CORRDINATES
345     IF INSTR(1,ARROW$,A$)=0 THEN  IF NSTEP% THEN 280 ELSE 40000
348     X(0) = INT((XMAX-XMIN)/2 +XMIN)    : Y(0) = INT((YMAX-YMIN)/2 +YMIN)
        : X(1) = X(0)                      : Y(1) = Y(0)
          : N%     = 0 : X = FRE("") : GOSUB 30449
349     XINC = INT((XMAX-XMIN)/32) : YINC = INT((YMAX-YMIN)/32)
        : TX = XINC/2  : TY = YINC/2  : CALL INITHCUR(TY,TX,BGREEN%)
          : GOTO 385
375     A$ = INPUT$(1)
        : IF A$ = " " OR A$ = CR$ THEN 390
376     IF A$ = LFT$ THEN X(N%) = X(N%) - XINC
          ELSE IF A$ = RGHT$ THEN X(N%) = X(N%) + XINC
377     IF A$ = DWN$ THEN Y(N%) = Y(N%) - YINC
          ELSE IF A$ = UP$ THEN Y(N%) = Y(N%) + YINC
378     IF X(N%) <XMIN THEN X(N%) =X(N%)+XINC
          ELSE IF X(N%) > XMAX THEN X(N%) = X(N%)-XINC
379     IF Y(N%) <YMIN THEN Y(N%) =Y(N%)+YINC
```

```
            ELSE IF Y(N%) > YMAX THEN Y(N%) = Y(N%)-YINC
380         IF A$="+" THEN XINC=XINC*2:YINC=YINC*2
381         IF A$="-" THEN XINC=INT(XINC/2):YINC=INT(YINC/2)
385         CALL MOVHCURABS(X(N%),Y(N%))
386         TY%=40 :TX%=41 :T$=FNPADF$(X(0),7)+" "+FNPADF$(Y(0),7)+" "
            + FNPADF$(X(1),7)+" "+FNPADF$(Y(1),7):CALL FTLOCATE(TY%,TX%)
              : CALL FTEXT(T$) : GOTO 375
390         CALL DELHCUR:CALL SETCOLOR(TEXT%):TX=X(N%)-XINC/2:CALL PTABS(TX,Y(N%
)):TX=X(N%)+XINC/2:CALL LNABS(TX,Y(N%)):TY=Y(N%)-YINC/2:CALL PTABS(X(N%),TY):T
Y=Y(N%)+YINC/2:CALL LNABS(X(N%),TY):  IF N%=0 THEN N%=1 : GOTO 385
392         XMIN = X(0) : XMAX = X(1) : YMAX = Y(0) : YMIN = Y(1)
            : GOSUB 64510 : FIRST% =-1
              : GOTO 114
9999      ' ********************************************************************
            '                  ERROR ROUTINE
              '
10000       IF ERL=50310 AND (ERR=9 OR ERR=5) THEN RESUME 50320
            '       (EXPECTED) SUBSCRIPT OUT OF RANGE OR ILLEGAL FN CALL
              '       WHEN COLOR DISPLAY IS CLIPPED
10003       IF ERR = 14 THEN X = FRE("")-FRE(0) :BEEP : RESUME
10008       IF ERL = 95 AND ERR = 53
              THEN LOCATE 25,21 :PRINT "Parameter File ("+PARAM.FIL$+") not Fo
und"              :XMIN=0 :XMAX=200000! :YMIN=0 :YMAX=200000! :CLOSE #4 :RESU
ME 97
10010       IF ERR = 62 AND ERL>250 AND ERL<330
              THEN  ER$ = "End of Oilspill file encountered" : GOSUB 64500
                : GOSUB 30450 : RESUME 40000
10020       IF ERL = 97 AND ERR = 53
              THEN  ER$ = "Shore F   ("+SHORE.FIL$+") Not Found."  : GOSUB 65
000               : RESUME                          ' CAN'T FIND SHORE FILE
10030       IF ERL = 30310 AND ERR = 53
              THEN  ER$ = "Oilspill File ("+OIL.FIL$+") Not Found." : GOSUB 65
000               : RESUME 30309
10035       IF ERR=24 THEN ER$ = "PLOTTER ERROR " : GOSUB 64500 PLOTTER% = 0
            : RESUME
10040       IF ERL = 20 THEN RESUME 21     'CAN'T FIND FILE FROM MENU PROGRAM
10999       ER$ = "ERROR OCCURRED"  : CALL CLOSEGRAPHICS : PRINT ERR,ERL
            : GOSUB 65000 : LOCATE 24,1 : PRINT "ERROR:";ERR;" ERROR LINE:";ERL
              : ERROR ERR  : STOP
29999     ' ********************************************************************
            '       CLEAR SCREEN, DRAW BORDER, ETC
              '
30000       CALL SETCOLOR(LAND%) : CALL CLR
            : T% = 1 : CALL SETHATCHSTYLE(T%)
              : IF BW% THEN 30009
30001     '       PRINT UP THE LEGEND OF COLOR VALUES IF IN COLOR
30002       IF PLOTTER% THEN PRINT #4, "SC 0,";XPIXELS%;",";-YPIXELS%;",0;"
            : PRINT #4, "SP7;PU ";XPIXELS%-13*8;",";-1*((36-NCOL%)*10+8);
                ";PD;LO11;LB   Gallons"+ETX$
30003       CALL WORLDOFF : TX% = XPIXELS%-13*8 :TX1% = TX%+7 :T1%=69
            : FOR I% = 0 TO NCOL% : TY%=(I%+37-NCOL%)*10-1 : TY1%=TY%+9
              : CALL SETCOLOR(COL%(I%)) :CALL BAR(TX%,TY%,TX1%,TY1%)
30004       IF PLOTTER% THEN PRINT #4, "SP ";I%+1;";PU ";TX%;",";-TY1%;
                ";PD;RA ";TX1%;",";-TY%;"; EP;LO11;"
30005       T%=I%+38-NCOL% :CALL FTLOCATE(T%,T1%)
```

```
        : T$=" "+FNPADN$(INT(GCOL(I%)+1),5)+"-"+FNPADN$(INT(GCOL(I%+1)),5)
          : CALL FTEXT(T$) : IF PLOTTER% THEN PRINT #4,"LB"+T$+ETX$
30006     NEXT
30007     T%=37-NCOL% : CALL FTLOCATE(T%,T1%)
          : T$="  Gallons    " : CALL FTEXT(T$)
30009     CALL SETWORLD(XMIN,YMIN,XMAX,YMAX)
30012     IF PLOTTER%=0 THEN 30015 ELSE PRINT #4, "DF; IP 80,640,10080,7520;"
30013     PRINT #4,"SP8;SC ";XMIN;",";XMAX;",";YMIN;",";YMAX;";"
          : PRINT #4,"PU ";XMIN;",";YMIN;";EA ";XMAX;",";YMAX;";"
            '         SET PLOTTER TO DEFAULT, SET SCALING, AND DRAW RECT.
30015     RETURN
30020     ERASE OIL% : DIM OIL%(92,58) : RETURN
30049   ' ********************************************************************
*           '         SUBROUTINE TO GET INPUT FROM USER
            '
30050     CLS
30051     PRINT "The plotting area is currently defined by :"+CRLF$
              +"        X-min :";XMIN; CRLF$+"        X-max :";XMAX;CRLF$
                +"        Y-min :";YMIN; CRLF$+"        Y-max :";YMAX : PRINT
30060     PRINT CRLF$ + "You have the option to change the scale after you h
e"        + " seen the plot by using" + CRLF$ + "the arrow keys or the 'C' key
."
30061     IF STEP.NO% = 0 THEN
          : INPUT "Would you like to change the scale <N>"; A$
            : A$=FNUPPER$(A$+"N") : IF A$="N" THEN RETURN ELSE IF A$<>"Y" THEN
 30061
30065     PRINT " Enter X-min <";XMIN;"> ";  : INPUT A$
          : IF A$<>"" THEN XMIN = VAL(A$)
30067     PRINT " Enter X-max <";XMAX;"> ";  : INPUT A$
          : IF A$<>"" THEN XMAX = VAL(A$)
30068     IF XMAX<=XMIN THEN PRINT CRLF$+"X-min must be less than X-max."+CRLF
$         : GOTO 30065
30069     PRINT " Enter Y-min <";YMIN;"> ";  : INPUT A$
          : IF A$<>"" THEN YMIN = VAL(A$)
30070     PRINT "Suggested values for Y-max are :" + CRLF$;
          INT(149/245*(XMAX-XMIN)+YMIN);" for no distortion on screen" +CRLF$;
            INT(172.5/250*(XMAX-XMIN)+YMIN);" for no distortion on plotter"
30071     PRINT " or ";YMAX;", the data-file default"
          : PRINT " Enter Y-max <";YMAX;"> "; : INPUT A$
            : IF A$<>"" THEN YMAX=VAL(A$)
30072     IF YMAX<=YMIN THEN PRINT CRLF$+"Y-min must be less than Y-max."+CRLF
$         : GOTO 30069
30074     RETURN
30079   ' ********************************************************************
30080     GOSUB 30050                                 'PRINT CURRENT RIVER BOUNDRIES
30081     CLS :PRINT "Please enter the number of time-steps you would like to"
          + " see--"+CRLF$+" (Enter -1 to see all time-steps or 0 to see just"
            + " the river boundry)"
30082     PRINT
          : INPUT "Number of steps "; NSTEP%
30090     STP%(0) = -1
          : FOR I% = 1 TO NSTEP%
30091     INPUT "Please enter step number :"; STP%(I%)
30092     IF STP%(I%) <= STP%(I%-1) THEN
               PRINT CRLF$ + "Each step number must be greater than the last -
```

```
-"              + " Please re-enter last step." : GOTO 30091
30093       NEXT   BW% = -1 : IF NSTEP%=0 THEN 30097 ELSE
                PRINT CRLF$+"Which would you like to see: Monochrome or Color ?"
30094       INPUT "Enter M or C <M>";A$ : A$ = FNUPPER$(A$+"M")
            : IF A$ = "C" THEN BW% = 0 ELSE IF A$<>"M" THEN 30094
30095       MLT%=0 : IF NSTEP%=-1 OR NSTEP%>1 THEN PRINT
           : INPUT "Would you like to see multiple plots on the same graph <N>";
A$            : A$=FNUPPER$(A$+"N"): IF A$="Y" THEN MLT%=-1 ELSE IF A$<>"N" THEN
30095
30097       PRINT CRLF$+"Do you want geographic locations and labels to appear <
N>";        : INPUT A$ : A$ = FNUPPER$(A$+"N")
              : IF A$="N" THEN GEO%=0 ELSE IF A$="Y" THEN GEO%=-1 ELSE 30097
30098       PRINT CRLF$+"Do you want mile markers and labels to appear <N>";
            : INPUT A$ : A$ = FNUPPER$(A$+"N")
              : IF A$="N" THEN MM%=0 ELSE IF A$="Y" THEN MM%=-1 ELSE 30098
30099       PRINT : INPUT "Do you want a plotter output <N> ";A$
            : A$ = FNUPPER$(A$+"N")
              : IF A$="N" THEN PLOTTER%=0 ELSE IF A$="Y" THEN PLOTTER%=-1 ELSE 3
0099
30100       IF PLOTTER% THEN CLOSE #4
                : OPEN "COM1:9600,S,7,1,RS,CS65535,DS,CD" AS #4
30101       GOSUB 45000                                          'SET UP FOR GRAPHICS
30105       RETURN
30199   ' ***************************************************************
          '                          ROUTINE TO PLOT SHORELINE
            '
30200     '
30248       IF PLOTTER% THEN PRINT #4,"SC;IW 80,640,10080,7520;"
30249       CALL SETCOLOR(TEXT%):CALL MOVABS(XSPOT,YSPOT):R=(XMAX-XMIN)/196:T=PI
/2:THETA=T-.01:CALL PIE(R,T,THETA,LAND%):T=PI:THETA=3*PI/2:CALL PIE(R,T,THETA,
LAND%):T=0:CALL PIE(R,THETA,T,LAND%)  ' LABEL SPILL SITE
30250       IF PLOTTER% THEN PRINT #4,"SC ";XMIN;                    ",";XMAX;",";YMI
N;",";YMAX;";PU;"       ' LABEL SPILL SITE ON PLOTTER
30251       IF PLOTTER% THEN PRINT #4,"SP7;PU ";XSPOT;",";YSPOT;
                ";SC 80,10080,640,7520;PD;EW 40,0,270;EW 40,180,270;PU;SC ";XMIN
;                 ",";XMAX;",";YMIN;",";YMAX;";PU;"       ' LABEL SPILL SITE ON PL
OTTER
30254       X=(XMAX-XMIN)/256:Y=(YMAX-YMIN)/256
            : IF PLOTTER% THEN PRINT #4,"SR .45,.9;"            ' MAKE TEXT BE SMAL
L
30255       FOR I% = 2 TO CNTG%+1
            : GET #1, I% :T%=VAL(TGP$):TX= CVS(XGP$) :TY= CVS(YGP$) : T$ = PGP$+
""            : TX1=TX-X : TX2=TX+X : TY1=TY-Y : TY2=TY+Y
30256       IF (NOT GEO%) OR T%<>1 THEN 30260 ELSE
                : CALL PTABS(TX1,TY) : CALL LNABS(TX2,TY) : CALL PTABS(TX,TY1)
                  : CALL LNABS(TX,TY2) : CALL MAPWTOD(TX,TY,TX%,TY%)
30257       IF PLOTTER% THEN PRINT #4,"PU ";TX1;",";TY;"; PD ";TX2;",";TY;
                ";PU ";TX;",";TY1;";PD ";TX;",";TY2;";" LO12;LB"+T$+ETX$
30258       TX%=INT(TX%/8)+2 : TY%=INT(TY%/10)+1
            : IF TX%>0 AND TX%<73 AND TY%>0 AND TY%<39 THEN
                  CALL FILOCATE(TY%,TX%) : CALL FITEXT(T$)
30260       IF (NOT MM%) OR T%<>2 THEN 30264 ELSE
                CALL PTABS(TX1,TY1):CALL LNABS(TX2,TY1):CALL LNABS(TX,TY2)
                 :CALL LNABS(TX1,TY1):CALL MAPWTOD(TX,TY,TX%,TY%)
30261       T$ = LEFT$(T$,2)
```

```
        : IF PLOTTER% THEN PRINT #4,"PU ";TX2;",";TY1;"; PD ";TX1;",";TY1;
              ";PD ";TX;",";TY;";PD ";TX2;",";TY1;";";" LO12;LB"+T$+ETX$
30262   TX%=INT(TX%/8)+2 : TY%=INT(TY%/10)+1
        : IF TX%>0 AND TX%<77 AND TY%>0 AND TY%<39 THEN
             CALL FTLOCATE(TY%,TX%) : CALL FTEXT(T$)
30264   NEXT : X=FRE("")
        : IF PLOTTER% THEN PRINT #4,"SR;IW;"      'GET TEXT BACK TO NORMAL SI
ZE
30265   R=(XMAX-XMIN)/20 : T1=(YMAX-YMIN)/(XMAX-XMIN) ' NOW DO NORTH ARROW
30267   TX=XMIN+2*R : TY=YMAX-2*R*T1: CALL MOVABS(TX,TY): X=XMIN+R :Y=YMAX-R
*T1 :N1 = 180!/PI*NORTH+180: CALL SETCOLOR(TEXT%) : IF PLOTTER% THEN PRINT #4,
"SP7;PU ";X;",";Y;";EW ";R;",";N1;",0; EW ";R/6!;",";N1+30;",0; EW ";R/6!;",";
N1-30;",0;"
30268   IF PLOTTER% THEN PRINT #4, "PU ";XMIN+.7*R;",";Y;";LO12;LBN"+ETX$
30269   TX1=R*COS(NORTH)+TX : TY1=R*SIN(NORTH)*T1+TY
        : CALL LNABS(TX1,TY1) : TX=PI/6!-NORTH : TY = PI/6!+NORTH : T=.33*R
30270   TX2=-T*COS(TX) : TY2=T*SIN(TX)*T1    : CALL LNREL(TX2,TY2)
30272   TX2=-T*COS(TY) : TY2=-T*SIN(TY)*T1    : CALL MOVABS(TX1,TY1)
        : CALL LNREL(TX2,TY2)
30274   T$ = "N" : TX%=9 : TY%=4 : CALL FTLOCATE(TY%,TX%) : CALL FTEXT(T$)
30275   IF PLOTTER% THEN PRINT #4, "IW 80,640,10080,7520;SP8"
30276   CALL SETCOLOR(SHRLNE%) : FOR I% = 2 TO CNT%+1
        : GET #3, I% : X = CVS(XPT$) : Y = CVS(YPT$)
30277   IF CVI(PPT$) THEN CALL PTABS(X,Y) ELSE CALL LNABS(X,Y)
        '       PLOT POINT IF I'M NOT SUPPOSED TO DRAW LINE
30278   IF PLOTTER% THEN IF CVI(PPT$) THEN PRINT #4,"PU ";X;",";Y;";PD;"
          ELSE PRINT #4,"PD ";X;",";Y;";"
30279   NEXT : IF PLOTTER% THEN PRINT #4, "IW;SP7" 'GET RID OF WINDOWING
        '       NOW I'M DONE DRAWING THE ACTUAL SHORELINE
30280   RETURN
30308 ' ************************************************************************
        '                    OPEN UP THE OIL SPILL FILE
        '
30309   PRINT : PRINT "What oil spill file would you like to look at <"+RIV$
        + "SP.OUT> "; : INPUT OIL.FIL$
          : IF OIL.FIL$ = "" THEN OIL.FIL$ = RIV$+"SP.OUT"
30310   OPEN OIL.FIL$ FOR INPUT AS #2
30312   LINE INPUT #2, T$ : TITLE$ = LEFT$(T$,44)
        : FOR I% = 1 TO LEN(TITLE$) : IF MID$(TITLE$,I%,1)<>" " THEN 30314
30313   NEXT : I% = LEN(TITLE$)+1      'LOOP TO GET RID OF LEADING SPACES
30314   TITLE$ = FNPAD$(MID$(TITLE$,I%),40)
        : OIL$ = FNPAD$(MID$(T$,45),16)
          '       TITLE OF RIVER AND TYPE OF OIL
30315   LINE INPUT #2, T$
        : NPART% = VAL(LEFT$(T$,5)) : SPILL.V = VAL(MID$(T$,6,8))
          : DELTA.T% = VAL(MID$(T$,14,6)) : SPEC.GRAV = VAL(MID$(T$,21,6))
30316   '       NPART% IS THE NUMBER OF PARTICLES DROPPED
        '         SPILL.V IS THE SPILL VOLUME IN GALLONS
          '         DELTA.T% IS THE TIME DIFFERENCE BETWEEN STEPS (IN SECONDS)
30317   '       SPEC.GRAV IS THE SPECIFIC GRAVITY OF THE OIL (UNITLESS)
30318   LINE INPUT #2, DAT$
        : XSPOT = VAL(MID$(DAT$,1,8))  : YSPOT = VAL(MID$(DAT$,9,7))
          ' GET X AND Y LOC OF OIL SPILL SITE (REMAINDER OF DATA ISN'T NEEDE
D)
30319   NLINES% = (NPART%+4) \ 5
```

```
          ' CALCULATE THE NUMBER OFLINES THAT THE PAIRS OF POINTS WILL OCCUPY
30320     STP.NO% = 0  : DONE% = 0 : S$=" "
          '       SET CURRENT STEP NUMBER AND WHETHER I AM FINISHED PRINTING
30325     RETURN
30379   ' ************************************************************************
          '       SUBROUTINE TO PRINT PARAMETERS ON THE SCREEN
            ,
30380     T$=TITLE$+FNPADF$(XMIN,7)+" "+FNPADF$(YMIN,7)+" "
          + FNPADF$(XMAX,7)+" "+FNPADF$(YMAX,7)+"  "+S$+" "+FNPADN$(STEP.NO%,3
)           + "  " :TX% = 1 :TY% = 39 :CALL FTLOCATE(TY%,TX%) :CALL FTEXT(T$)
30382     IF STEP.NO%=0 OR S$="S" THEN 30390
30384     T$=FNPAD$(" "+FNST$(INT(.5+10*WIND/CNV)/10)+"mph  "+FNST$(ELAPSE.T)+
" hrs after "+FNST$(SPILL.V)+" gal of "+OIL$+" spilled.",64-13*BW%) :TX%=4 :TY
%=38 :CALL FTLOCATE(TY%,TX%) :CALL FTEXT(T$)
30386     PRT% =0 :T% = TEXT% : GOSUB 30395 ' DRAW WIND VELOCITY VECTOR ON CRT
30390     RETURN
30394   ' ************************************************************************
          '       SUBROUTINE TO DRAW OR ERASE WIND VELOCITY VECTOR
            ,
30395     TY% = 367 : TX% = 12 :CALL MAPDTOW(TX%,TY%,TX,TY) :CALL MOVABS(TX,TY
)         : T1 = (YMAX-YMIN)/(XMAX-XMIN) :P%= (PLOTTER% AND (T%<>LAND%) AND PR
T%)         : IF P% THEN PRINT #4, "SP7;PU ";TX;",";TY-(YMAX-YMIN)/16;";"
30396     IF WINDX=0! THEN THETA =PI/2!*SGN(WINDY)
              ELSE THETA = ATN(WINDY/WINDX)
                  : IF WINDX<0 THEN THETA = THETA + PI
30397     CALL SETCOLOR(T%) :R=(XMAX-XMIN)/50 :TX1=R*COS(THETA)+TX:TY1=R*SIN(T
HETA)*T1+TY:CALL LNABS(TX1,TY1):TX=PI/6!-THETA:TY=PI/6!+THETA:T=.33*R
            : TH = 180!/PI*THETA : IF P% THEN PRINT #4, "EW ";R;",";TH+180;",0
;"
30398     TX2=-T*COS(TX) : TY2=T*SIN(TX)*T1    : CALL LNREL(TX2,TY2)
          : IF P% THEN PRINT #4, "EW";R/6;",";TH+150;",0;EW";R/6;",";TH+210;",
0;"
30399     TX2=-T*COS(TY) : TY2=-T*SIN(TY)*T1    : CALL MOVABS(TX1,TY1)
          : CALL LNREL(TX2,TY2)
30400     RETURN
30448   ' ************************************************************************
          '                 PUT FINAL LABEL ON PLOTTED OUTPUT
            ,
30449     IF NOT MLT% THEN RETURN
30450     IF PLOTTER% = 0 OR S$ = "S" THEN RETURN
30455     T$=TITLE$+FNPADF$(XMIN,7)+" "+FNPADF$(YMIN,7)+" "
          + FNPADF$(XMAX,7)+" "+FNPADF$(YMAX,7)
            : PRINT #4,"SP7;IW;PU ";XMIN;",";YMIN;";LO 13;LB"+T$+ETX$
30460     IF STEP.NO%=0 THEN 30490
30462     IF MINW=MAXW THEN T$ = "    "+FNST$(INT(.5+10*WIND/CNV)/10)+"mph  "
              ELSE T$ = "    "+FNST$(INT(.5+10*MINW/CNV)/10)+" to "+FNST$(MAXW/
CNV)+"mph  "
30463     IF STIME = ETIME THEN T$=T$+FNST$(ELAPSE.T)
              ELSE T$=T$+FNST$(STIME)+" to "+FNST$(ETIME)
30464     T$=T$+" hrs after "+FNST$(SPILL.V)+" gal of "+OIL$+" spilled."
30465     PRINT #4, "LB"+CR$+INV$+T$+ETX$
30467     PRT% = -1 : GOSUB 30395    ' DRAW WIND VELOCITY VECTOR TO PLOTTER
30490     PRINT #4,"SP0;PU;PG;" : X = FRE("") : RETURN
35999   ' ************************************************************************
          '                 SAVE XMIN ETC INTO PARA.SHO FILE
```

```
          '
36000     OPEN PARAM.FIL$ FOR OUTPUT AS #4
          : PRINT #4, XMIN;",";YMIN;",";XMAX;",";YMAX
            : CLOSE #4 : X = FRE("") : RETURN
39999     ' ****************************************************************
          '                    GIVE USER OPTION TO PLOT MORE
            '
40000     CALL CLOSEGRAPHICS : LOCATE 5,1
40005     PRINT "Would you like to see more plots of this spill <Y> ";
          : INPUT A$ : A$=FNUPPER$(A$+"Y")
            : IF A$="Y" THEN 40010 ELSE IF A$<>"N" THEN 40005
40006     PRINT
40007     PRINT "Would you like to see more plots of this river <Y> ";
          : INPUT A$ : A$=FNUPPER$(A$+"Y")
            : IF A$="N" THEN 65100 ELSE IF A$<>"Y" THEN 40007 ELSE 40011
40010     CLOSE #2 : X = FRE("")  : GOTO 100
          '          SAME SPILL
40011     PRINT : PRINT "What oil spill file would you like to look at <"+RIV$
          + "SP.OUT> "; : INPUT OIL.FIL$
            : IF OIL.FIL$ = "" THEN OIL.FIL$ = RIV$+"SP.OUT"
40012     CLOSE #2 : X = FRE("") : GOTO 100
          '          SAME RIVER, DIFFERENT SPILL
40999     ' ****************************************************************
          '                    ROUTINE TO DETERMINE COLOR
            '
41000     C1% = 0
          : FOR I1% = 1 TO NCOL%
            : IF OIL%(I%,L%) > BCOL%(I1%) THEN C1% = I1%
41010     NEXT : RETURN
41999     ' ****************************************************************
          '                    ROUTINE TO CLASSIFY COLORS
            '
42000     IF GCOL(0)<>0  THEN FOR I% = 0 TO NCOL%
              : GCOL(I%) =10*I%*GAL.PRT : NEXT : GCOL(NCOL%+1)=NPART%*GAL.PRT
            '          SET DEFAULT BREAK POINTS IF NECESSARY
42029     CALL CLOSEGRAPHICS
42030     CLS : PRINT "Color Classification:" : PRINT " ";NPART%;"Patches, ";
            GAL.PRT;"Gal/Patch, ";NPART%*GAL.PRT;"Gal Total, ";NBOX%;"Boxes"
42032     FOR I% = 0 TO NCOL% : TMP%(I%) = 0  : NEXT : TMP% = 0    ' ZERO TOTAL
S
42035     FOR I% = 0 TO NCOL%+1
          : BCOL%(I%) = INT(GCOL(I%)/GAL.PRT)
            : NEXT  ' CONVERT THE GAL PER BOX CONCENTRATIONS TO PART PER BOX
42040     FOR L% = YMN% TO YMX%  : FOR I% = XMN% TO XMX%
          : IF OIL%(I%,L%) <> 0  THEN GOSUB 41000
                : TMP%(C1%) = TMP%(C1%) + 1  : TMP% = TMP% + 1
42045     NEXT  : NEXT
42060     FOR I% = 0 TO NCOL%
          : PRINT USING PU$; TMP%(I%); GCOL(I%)+1; GCOL(I%+1)
            : NEXT
42080     PRINT
          : INPUT "Would you like to change the Color Classifications <N>";A$
            : A$=FNUPPER$(A$+"N"):IF A$="N" THEN RETURN ELSE IF A$<>"Y" THEN 4
2080
42090     PRINT "Please enter the cut-off points for the color classifications
```

```
"          +CRLF$+"Make sure that you type them in in ascending order:"
           : FOR I% = 1 TO NCOL%  : PRINT USING "Old value: ####.#  ";GCOL(I%
);
42095      INPUT "New density value :"; GCOL(I%)
           : NEXT
             : GOTO 42030
42999    ' ************************************************************************
           '          ROUTINE TO FIND MIN AND MAX X AND Y VALUES OF COLOR DISPLAY
             '
43000      YMN% = -1
           : XMN% = XNUM%
             : XMX% = 0 : NBOX% = 0
43010      FOR L% = 0 TO YNUM%   : FOR I% = 0 TO XNUM%
           : IF OIL%(I%,L%)= 0 THEN 43040  ELSE  NBOX%=NBOX%+1
             : IF YMN%<0 THEN YMN% = L%
43020      YMX%=L%
           : IF XMN%>I% THEN XMN% = I%
43030      IF XMX%<I% THEN XMX% = I%
43040      NEXT  : NEXT : RETURN
           '        FIND MIN AND MAX X AND Y VALUES FOR DISTRIBUTION OF OIL SPIL
L
44999    ' ************************************************************
           '                          DEFINE STUFF FOR COLOR DISPLAY
             '
45000      GCOL(0) = -1!
           : FIRST%  = -1
             '        FLAG TO REMIND ME TO SET DEFAULT COLOR DISTRIBUTION
45026    ' NOTE INTENTIONAL FALL-THROUGH
45027    ' ************************************************************************
*            '                  SUBROUTINE TO ENTER GRAPHICS MODE
             ' ********************* ********************************
*****
45028      MODE% = 6
           : CALL INITGRAPHICS(MODE%)
             : T% = 1 : CALL SETLNSTYLE(T%)
45029      CALL FTCOLOR(TEXT%,BACK%) : T% = 1 : TX% = 10
           : CALL FTSIZE(T%,TX%) : CALL FTINIT
             '        GET SET TO DISPLAY FAST TEXT ON SCREEN
45030      RETURN
47999    ' ************************************************************************
**           '              ROUTINE TO MAKE SURE XMIN, XMAX IN ORDER
             '
48000      IF YMAX<YMIN THEN SWAP YMAX, YMIN
48010      IF XMAX<XMIN THEN SWAP XMAX, XMIN
48020      RETURN
50299    ' ************************************************************
           '                    DRAW THE OIL SLICK (IN COLOR OR BW)
             '
50300      IF NOT BW% THEN 50303 ELSE
               IF FIRST% OR NOT MLT% THEN GOSUB 30000  : GOSUB 30200
             '        SET UP THE SCREEN AND DRAW SHORELINE
50301      CALL SETCOLOR(OILCOL%)
           : IF PLOTTER% THEN PRINT #4, "SP8";
50302      GOTO 50305
50303      CALL SETWORLD(XMIN,YMIN,XMAX,YMAX) :TY%=40:TX%=25
```

```
          : CALL FTLOCATE(TY%,TX%):T$="Compiling Color Information..."
            : CALL FTEXT(T$)
50305      X = FRE("") : FOR IP% = 1 TO CNPART%
           : IF PX(IP%) = 0 AND PY(IP%) = 0 THEN 50320      ' A SLOW LEAK PARTI
CLE
50308      IF BW% THEN CALL PTABS(PX(IP%),PY(IP%))
               : IF PLOTTER% THEN PRINT #4, "PU ";PX(IP%);",";PY(IP%);"; PD;"
50310      IF NOT BW% THEN CALL MAPWTOD(PX(IP%),PY(IP%),TX%,TY%)
               : TX%=TX%\XPIX% :TY%=TY%\YPIX% : OIL%(TX%,TY%)=OIL%(TX%,TY%)+1
50320      NEXT
           : IF BW% THEN 50342                          ' COLOR OR B+W DISPLAY?
50333      GOSUB 43000 ""IF (NOT FIRST%) AND MLT% THEN GOSUB 30380
             '         FIND MIN AND MAX X AND Y VALUES FOR COLOR DISPLAY
50334      IF FIRST% OR NOT MLT% THEN GOSUB 42000 : GOSUB 45027
           : GOSUB 30000  : GOSUB 30200
             '         GET CONCENTRATIONS, SET UP THE SCREEN AND DRAW SHORELINE
50335      CALL WORLDOFF
50336      IF PLOTTER% THEN PRINT #4, "SC 0,";XPIXELS%;",";-1*YPIXELS%;",0;"
           '       CHANGE PLOTTER TO HAVE SAME COORDINATES AS SCREEN
50337      FOR L% = YMN% TO YMX%  : FOR I% = XMN% TO XMX%
           : IF OIL%(I%,L%)=0 THEN  50341
50338      GOSUB 41000 :CALL SETCOLOR(COL%(C1%)):TX%=I%*XPIX%:TY%=L%*YPIX%
           : TX1%=TX%+XPIX%-1:TY1%=TY%+YPIX%-1:CALL BAR(TX%,TY%,TX1%,TY1%)
50339      IF PLOTTER% THEN PRINT #4, "SP ";C1%+1;";PU ";TX%;",";-1*TY%;";RA ";
TX1%;",";-1*TY1%;";EP;"
50341      NEXT  : NEXT : CALL SETWORLD(XMIN,YMIN,XMAX,YMAX)
           : ERASE OIL% : DIM OIL%(92,58)
50342      GOSUB 30380
50343      IF PLOTTER% THEN PRINT #4, "PU;SP0;"
               + "SC ";XMIN;",";XMAX;",";YMIN;",";YMAX;";"
             : IF NOT MLT% THEN GOSUB 30450
50344      RETURN
62999    ' ***************************************************************
           '                          SET UP STUFF
63000      KEY OFF : RETURN
64000    '---------------------------------------------------------------------
           '       Shell for writing basic graphics programs with HALO
         '-------------------------------------------------------------
----
64003  BAR = &H28B : BOX = &HA1 : CIR = &H77 : CLOSEGRAPHICS = &H2C3 : CLR = &
H2CA : DEFHATCHSTYLE = &HBD
64004 DEFLNSTYLE = &H516 : DELBOX = &H21B : DELCIR = &H222 : DELHCUR = &H292 :
 DELLN = &H229 : DELTCUR = &H299 : ELLIPSE = &H70 : FCIR = &H93 : FILL = &H9A
: FLOOD2=&HAF : FTCOLOR = &H103
64005 FTEXT = &H10A : FTINIT = &H111 : FTLOCATE = &H118 : FTSIZE = &H11F : HAL
LOC = &H46E : HFREE = &H475
64006 INITGRAPHICS = &H302 : INITHCUR = &H2A0 : INITTCUR = &H2A7
64007  INQERR = &H54 : INQFT = &H126 : INQFTCOLOR = &H12D : INQFUN = &H31E : I
NQGCUR = &H5B : INQHCUR = &H3F
64008 INQTCUR = &HF5 : INQTEXT = &HE0 : INQTSIZE = &HFC : INQVERSION = &H1A4 :
 INQWORLD = &H181 : LNABS = &H15 : LNJOINT = &H52B : LNREL = &H1C
64010 MAPDTON = &H17A : MAPDTOW = &H15E : MAPNTOD = &H173 : MAPNTOW = &H16C :
MAPWTOD = &H157 : MAPWTON = &H165 : MOVABS = &H23 : MOVHCURABS = &H31 : MOVHCU
RREL = &H38 : MOVREL = &H2A : MOVTCURABS = &HE7 : MOVTCURREL = &HEE
64012  PIE = &H7E : POLYLNABS = &H508 : POLYLNREL = &H50F : PTABS = &H7: PTNOR
```

```
M=&H3A3: PTREL = &HE
64014 SETASP = &H2AE : SETCLIP = &H13B : SETCOLOR = &H0 : SETDEGREE = &H501 :
SETDEV = &H261 : SETHATCHSTYLE = &HC4 : SETLNSTYLE = &H51D:SETLNWIDTH = &H524
64016 SETSTCLR = &H4B4 : SETSTEXT = &H4AD : SETTEXT = &HCB
  : SETTEXTCLR = &HD2 : SETVIEWPORT = &H134 : SETWINDOW = &H149 : SETWORLD = &
H142: SETXOR = &H1F8 : STARTGRAPHICS = &H452 : TEXT = &HD9 :WORLDOFF = &H150
64018 DEF SEG = &H3640 : BLOAD "HALOI.BIN",0 : DEVICE$ = "HALOTECM.DEV" : CALL
 SETDEV(DEVICE$) :X = FRE("") : RETURN
64499   ' ***************************************************************
          '              STANDARD HIT ANY KEY TO CONTINUE ROUTINE (GRAPHICS MODE
)           '
64500     TX% = 26-LEN(ER$)\2 : TY% = 40 . CALL FTLOCATE(TY%,TX%)
          : SOUND 150,4
            : ER$ = ER$+"    -- Hit any key to continue"  : CALL FTEXT(ER$)
64505      A$ = INPUT$(1) : X = FRE("")
64510     TX%=1 : TY% = 40 : CALL FTLOCATE(TY%,TX%) : CALL FTEXT(BLANK$)
          : RETURN
64999   ' ***************************************************************
          '              STANDARD HIT ANY KEY TO CONTINUE ROUTINE
            '
65000     LOCATE 25,26-LEN(ER$)\2
          : SOUND 150,4
            : PRINT ER$+"    -- Hit any key to continue";
65010      A$ = INPUT$(1) : LOCATE 25,1 : PRINT BLANK$; : RETURN
65099   ' ***************************************************************
          '              CLOSE UP AND SAY GOODBYE
            '
65100     CLOSE : CALL CLOSEGRAPHICS : LOCATE 5,22
          : PRINT "Returning to menu . . . please wait."
            : CHAIN "IPROGR.BAS" : END
```